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The Institute of Vitreous Enamellers
The Welsh Engineers' and Founders' Association
The Foundry Trades' Equipment and Supplies Association

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Hidden Metals

So far as the non-ferrous metals are concerned, and possibly with a number of other commodities also, the statisticians will have to content themselves with figures based on guesswork until the end of the war permits of the publication of details known at present only to the Controller. Copper has certainly achieved an all-time peak in consumption in the U.K., and this is probably true also of spelter, which enters into so many munition products at the present time. Aluminium is also, of course, running up a very large total in connection with aircraft manufacture. A usage on such a scale as this war demands, necessitates production to match it, and that this has been achieved through harnessing the potentialities of the British Empire is common knowledge; but what has to be borne constantly in mind is the fact that practically all our non-ferrous metal supplies, whether in the shape of ore or refined metal, come from overseas.

It is too much to expect that sinkings due to enemy action might not include some loss of metals, and it therefore behoves us to make the fullest possible use of all the metal which may be contained within the coasts of these islands. On the ferrous side, far-reaching action has been taken in order to secure for the prosecution of the war all available material, and the public has not only been encouraged to hand over its "old iron," but has also witnessed the removal of iron railings, etc., surrounding churches and public places. The latest survey to be conducted by the Iron and Steel Control, as we mentioned last week, reports some 20,000 tons of material available in the counties of Somerset and Glamorgan, and suggests that the final figure for the country will run out at around half a million tons. This is excellent news for the Iron and Steel Control, and the acquisition of this reserve tonnage is going to relieve the situation considerably on the new metal side as well as ridding the country of a great deal of unwanted stuff.

On the non-ferrous side, nothing comparable with this "census" has so far been attempted, the nearest approach to it being the "pots and pans" campaign which brought to light a considerable tonnage of aluminium. Other than that, there remains a reserve of what may be termed domestic brass and copper in a hundred and one different shapes and sizes, which could be garnered if the authorities thought it worth their while to put the machinery in motion to this end. Sorting and grading would be necessary, but this would not present any particular difficulty, for there are firms of experience in the scrap metal trade who could undertake this work for the Ministry of Supply.

What kind of a tonnage could be acquired in this way is a matter of pure guesswork, but if the net were spread widely enough, it would doubtless be very considerable. This aspect of the non-ferrous trade is normally looked after by the rag-and-bone man, who, after sorting his wares, passes the metal on in the appropriate direction for its eventual absorption into the manufacturing system.

Apart, however, from this domestic brass and copper, there is a certain quantity of dead stock in the various manufacturing plants up and down the country which ought to be brought out into the light of day and re-used. These accumulations will occur in spite of the existence of schemes intended to guard against them, but at a time like the present there should be a ruthless probing into every hole and corner in the search for usable metal. There are all sorts of reasons for the existence of these hidden reserves in industry, but what often lies at the root of the trouble is the very human tendency to encourage such hoarding because almost any material may be useful at some future date. This policy inevitably leads to accumulations which can reach very considerable dimensions if not taken in hand, and now is the time, with the end of the year in sight, to review the situation and place at the disposal of the foundry every ounce of metal that can usefully be employed in our great national effort.

Another source of hidden metal was revealed in an article we recently printed dealing with electro-magnetic methods of recovery. Unquestionably, there is a very large quantity of usable iron carted out of those foundries which have no modern system of sand reclamation. Yet it is the mechanised foundries which, realising the benefits derived from cleaning sand during the process of manufacturing castings, have installed magnetic machinery to "comb out" the rubbish before final despatch.

Selling Castings

THE PIECE-PRICE SYSTEM ADVOCATED

At a meeting of the Ontario Chapter of the American Foundrymen's Association, presided over by MR. D. STORIE, MR. H. S. SIMPSON, Vice-President of the Association, presented a Paper on the "Merchandising of Castings," in the course of which (as reported by "Canadian Machinery and Manufacturing News") he accused the foundry industry of being asleep, whilst those interested in welding and forging had spent thousands of dollars to bring greater engineering and public acceptance for their products. The result of this situation was that castings were given almost no consideration in the minds of many buyers, and it was time for the foundry industry to educate users to the merits of castings.

One foundry, said Mr. Simpson, had made remarkable advances in sales in recent years through a policy of taking engineering graduates, giving them a year of practical training in the foundry, placing them in the office for the acquisition of an understanding of costs, etc., and then sending them out on the road to sell castings through solving the problems of the user. This company recognised that it was useless making castings unless they could be sold, and their solution to the problem had been a most successful one.

Piece versus Pound

Price entered deeply into the selling of castings. They should be sold as manufactured articles at so much a piece rather than as pig-iron or non-ferrous metal at so much per pound. Another practical illustration showed how a foundry met a difficult selling problem. A man took over a dilapidated foundry, applied metallurgy to its production problems, and sent some of his key men to college for a two-year course. Finding that his customers knew very little about the particular type of castings he produced, he brought them into the plant for a short intensive course. At his first short course on the application of his castings to his customers' needs, 15 were present, and it was a tribute to his foresight that 350 assembled for his latest two-day study period.

In the discussion, largely devoted to the relative merits of piece *versus* pound prices, interesting points were presented on both sides. In favour of the piece price, it was pointed out that the buyer could not so readily compare the piece price as he could the pound price with the unjustifiably lower figure which might be offered by a competitor. Another point in which the merits of the piece price were apparent was in the marketing of small brass castings. In this field it was pointed out that the quoting of 60, 70 or even 90 cents per pound for small brass castings was not out of line with the work involved, but sounded like a high price to the customer. A price of 3 or 10 cents a piece would sound a lot better, while working out to the same rate per pound.

On the other side of the picture it was pointed out that piece prices on many items would be rather difficult to arrive at and that the pound price worked very satisfactorily where a definite schedule was adopted by an industry, as in the case of the steel casting industry in Canada. The price per pound was also held to be very useful in figuring out costs in many instances by the engineer or buyer.

In favour of the piece price, Mr. Simpson pointed out that a lighter, better casting might cost much more than a heavier one and would have to be considered as a manufactured article rather than as something at so much per pound, in order for the foundry to receive the value built into it for the customer.

Castings in the American Defence Programme

DR. G. B. WATERHOUSE, writing in "Metals and Alloys," outlines the position of iron and steel castings in the American defence programme. There will, he states, be many production problems in the foundry industry, that industry which has been transformed by metallurgists in the last few years. This applies to each of the three major branches, cast iron, malleable cast iron and steel. In each field increased production will be demanded and in each field products will have to be made that have not been among the products of the ordinary foundry.

There would seem to be great possibilities in adapting the rapid production methods of foundries to ordnance material of many types, and the metallurgist will find many ways in which the results of the intensive research of recent years can be applied to the new materials that will be demanded. Cast armour of various kinds will be required for many types of equipment and the metallurgist will have to help to work out the composition, casting practice and above all the heat treatment that will be necessary.

The newer types of ordinary and alloy cast irons are so wonderful in their properties that they can certainly be applied in many ways not thought of before, and the metallurgist will have to adapt these newer irons and their methods of production to the new demands. This also applies to the newer types of malleable cast iron with equal force.

Steps in Steel Casting

In regard to steel castings the field is almost unlimited. Foundrymen now can make steels of almost any composition and can control the analysis and cleanliness of the steels so as to obtain solid clean castings, which after heat-treatment give results comparable with forgings. Moulding practice, the mixing and treatment of sands and all the factors that enter into the production of good castings are much better understood than formerly so that with proper metallurgical control the results are uniform and good, and reliance can be placed on the product.

While emphasis will naturally be placed on the open-hearth and the electric furnace for producing liquid steel for castings, the small acid-lined converter should not be overlooked. Very few are now in operation but when it comes to a matter of rapid tonnage production of steel within its capabilities, nothing can equal the converter and the quality can be made exceedingly good and very uniform. The results obtained steadily over the years at the Boston Navy Yard will repay careful study, and the castings produced find numerous applications. Installation of a converter plant is not expensive nor is much time required and the methods of operation and metallurgical control are well understood.

Referring briefly to the heat-treatment of castings, including cast iron, malleable and steel, Dr. Waterhouse declares that this is a field where the metallurgist has shown what he can do and the opportunity for future work is exceedingly wide and the results for the Defence Programme will be of great importance.

A.F.A.'s Apprentice Contest

The Apprentice Training Committee of the American Foundrymen's Association announces that it is sponsoring competitions in moulding and patternmaking for 1941. These contests, started in 1924, have been especially successful in building up interest in organised trade training. That this is so is indicated by the fact that some 140 foundries and patternshops had apprentices competing in the last contest.

Random Shots

In a talk on "The War and the Shops," given over the air last week, the suggested formula for future expenditure was first to look at your shopping list once to see what could be easily crossed off; secondly, to look at it again to see if the list only contained essentials; thirdly, to look at it yet again to revise previous ideas as to what constitutes an essential. But "Marksman" suggests that this is an unnecessarily complicated method of determining expenditure. Instead, take one look at this month's salary cheque and compare it with the previous one. The question then decides itself.

* * *

It is hard to break a habit of a life time, apparently. The missus, who always used to say that putting onions into a stew made tears come to her eyes, now complains that she could cry her eyes out every time she has to make a stew without onions. Similarly, it is strange how one's mouth still waters whenever a lemon is mentioned!

* * *

"Turkey not to be bluffed," says a newspaper headline. Someone has evidently put one old bird wise to the fact that he is only fattened up in anticipation of a good Christmas dinner.

* * *

It is forbidden, so it seems, to publish any details regarding British ports. Ignorance is still to be bliss, apparently, as far as drinkers of Red Biddy are concerned.

* * *

A nurse complained to the doctor on his morning round of the wards that three German airmen who had been admitted the day before had given her a great deal of extra work during the night. One of them would keep on shouting out "Spitfire" at the top of his voice. It was the other two who kept her so busy.

* * *

The crossword clue of the week comes from the "Times."

Clue.—It starts with a nine days' blind.

Answer (*simply enough*).—"Kitten."

* * *

Another clue which is recorded more for its foundry flavour than for its piquancy comes from the "Daily Telegraph." The clue was "stain that has divided use in the foundry." The answer is "Ironmould."

* * *

"Who do you think you are? Hercules?" asked the barman of a customer who was trying to open a long-shut window. "It's not been open for years."

"No," came the ready reply from the customer, who opened the window easily. "Not Hercules, but Cyclops, with a single eye to your health as well as mine!"

* * *

"You never marry the man you court," sighed a young sales-lady to her companion on the next counter.

"Perhaps not," was the retort, "but many a man has found himself married to the girl who has caught him."

"MARKSMAN."

Smelting of Titaniferous Iron Ore

Titaniferous iron ore found in the province of Jehol, China, contains more than 50 per cent. Fe, 13 to 14 per cent. TiO_2 and 0.3 to 0.6 per cent. V. According to F. KAKIUCHI in "Tetsu to Hagane," iron and vanadium can be extracted from the ore with the simultaneous slagging of the titanium by mixing the crushed ore with 10 per cent. charcoal for reduction and with the requisite fluxing agent. After heating to 1,100 deg. to complete reduction of the iron, the temperature is subsequently raised to 1,300 deg. After pulverising, the metal and slag are separated. The iron yield is about 95 per cent.

The Iron and Steel Institute

AUTUMN MEETING AT SHEFFIELD

The Autumn Meeting of the Iron and Steel Institute, postponed from its customary date in September, was held last week at the Grand Hotel, Sheffield, jointly with the Sheffield Society of Engineers and Metallurgists and the Sheffield Metallurgical Association. Mr. John Craig, C.B.E., President of the Iron and Steel Institute, presided. Owing to the exigencies of the times, the meeting was restricted to only one day, but in view of the pressure on the steel industry at the moment, it is worthy of record that the attendance nearly trebled the most sanguine estimates.

The following programme was carried through:—

Programme

12.50 p.m. to 2.20 p.m.—Luncheon.

2.45 p.m. to 5.0 p.m.—Afternoon session for the transaction of official business and the discussion of the following Papers:—"The Manufacture of Steel by the Perrin Process," by B. Yaneske; "The Practical Side of Blast-Furnace Management, with Especial Reference to South African Conditions," by R. R. F. Walton; "An Accelerated Spray Test for the Determination of the Relative Atmospheric Corrodibility of Ferrous Materials," by T. Swinden and W. W. Stevenson (Paper No. 2/1940 of the Corrosion Committee (submitted by the Laboratory Research Sub-Committee)).

5.0 p.m. to 6.0 p.m.—Tea.

6.15 p.m. to 7.30 p.m.—Evening session for the discussion of the following Papers:—"Non-Metallic Inclusions in Steel—Quantitative Evaluation," by W. H. Hatfield, F.R.S., and G. W. Giles (Paper No. 3/1940 of the Committee of the Heterogeneity of Steel Ingots (submitted by the Inclusions Sub-Committee)); "The Influence of Some Special Elements upon the Strain-Ageing and Yield-Point Characteristics of Low-Carbon Steels," by C. A. Edwards, F.R.S., D. L. Phillips and H. N. Jones; "The Crystal Structure of Cementite, Fe_3C," by H. Lipson and N. J. Petch.

THE LUNCHEON

The loyal toast was duly honoured.

The DEPUTY LORD MAYOR (Alderman J. A. Longden, J.P.), proposing the toast of "The Iron and Steel Institute and Kindred Societies," said that he had much pleasure in doing so, because he knew the importance of the iron and steel industry, which was now recognised. He had said before, and he wished to repeat on the present occasion, that those connected with the heavy industries sought by association in such organisations as the Iron and Steel Institute to find the best. The Iron and Steel Institute and kindred bodies were of great value and benefit to industry, and he would urge them not to cease their labours, but to continue to carry out experiments and investigations which would make this country and Empire greater than ever. Workmen were of no use without technicians. Workmen used to say that they were the producers, but he thought it was now realised that the technicians or black-coated workers must be united with the workmen if this nation was to stand against its competitors. He wished the Iron and Steel Institute every success, and had much pleasure in coupling with the toast the name of the President.

The PRESIDENT, responding, said he found himself in complete agreement with the sentiments expressed by the Deputy Lord Mayor, and was sure that they would be endorsed by everyone present. The Institute had had considerable difficulty in arranging the meeting which it was holding that day. The times were not opportune for social gatherings, although the need for social gatherings was as great as ever, and, owing to the great reputation of its meetings, it had been afraid to venture, in case it might be confronted with an element of failure to which it was not accustomed. However, it had been felt that, if there was any place in Great Britain where the Institute could forgather in the present circumstances, that place was Sheffield, and that in Sheffield the members of the Institute could hold a joint meeting with members of two of the societies which still actively pursued their policy in Sheffield, namely, the Sheffield Metallurgical Association and the Sheffield Society of Engineers and Metallurgists. Therefore, the present meeting had been made possible by the happy co-operation of those two societies with the Iron and Steel Institute. Without that, the Institute could scarcely have hoped to hold such a great gathering, and it was particularly indebted to Dr. Hatfield, its senior Vice-President in Sheffield, for acting as chairman of the Committee of Arrangements and making the meeting possible. It would have been a pity if, at a time when the steel industry was so much in the minds of the public, the Institute had had to forgo its autumn gathering.

Continuing, the speaker said he agreed that the iron and steel industry was now recognised to be one of very great importance, and the members of the Institute were very glad of that, although they were sorry for the circumstances which had brought their industry into such prominence. They hoped, however, that the lesson of this time would be learned by the country as a whole. There was no time in the nation's history when the iron and steel industry had not been of importance. There were times when it had been neglected, but it had never been neglected without serious loss to the country, and if the country had taken a larger outlook and a more generous attitude towards the industry, it might have been better equipped than it had been in September, 1939. It was quite true that the steel trade could do without war—its happiest days had been without war—but it was certain that war could not do without the steel trade, and the steel industry was therefore faced with the fact that it was in the front rank of importance in the great crisis with which the country was confronted to-day.

He had been glad to hear the sentiments expressed by Alderman Longden, because there had been a time, as he had indicated once before to the Institute, when the technician and the scientist were regarded as having no great part to play, notwithstanding Dr. Hatfield and his colleagues, but now that there was a shortage of certain things, it was recognised that the scientist had helped in a remarkable way and had time and again submitted alternatives which had been effective and successful. Without the scientist he did not think that the steel trade could be in the position which it occupied to-day, and he therefore thought that the Institute, because of its great principle of fostering the development of technical education and scientific research, had proved abundantly that if there was any industry which needed the scientist, it was the steel trade. Greater demands were now being made upon the steel industry than had been made upon it at any previous time in its history, and he thought it could claim an honoured place among the country's great industries for what it had done, for what it was seeking to do, and for what he believed it would do in the future. He did not think the results which could arise from the scientific knowledge that was available for use in the steel industry had been exhausted. He hoped that the Institute would receive the support of all in the industry and that all who were associated with the industry would feel that it was through the Iron and Steel Institute that they could best develop the future success of their industry.

Concluding, the President thanked the Deputy Lord Mayor for his generous reference to the Institute, and he also wished to thank the two kindred societies in Sheffield for co-operating with the Institute in making the present meeting successful. The Papers to be submitted might be looked upon in times to come as historic, and the meeting might be regarded as a memorable one in the development of the iron and steel industry. Finally, he wished again to thank Dr. Hatfield for acting as chairman of the Joint Committee which had made the present meeting possible.

"The President"

DR. W. H. HATFIELD, F.R.S., proposing the toast of "The President," said that everyone present knew the great enterprise which Mr. Craig controlled, and recognised that it must have been difficult for him to come from Scotland to attend the meeting that day. He was very glad that Mr. Craig had been able to do so, because he thought that, although it was not possible to say much on the subject at the present moment, after the war it would be recognised that the Iron and Steel Institute, particularly through its various scientific and technical committees, had done well during the present critical period. On behalf of his scientific and technical colleagues in the industry, he wished to thank Mr. Craig for coming to the meeting. They felt, of course, that science and technology must be carried on in spite of the war. The war might last two years or five years, or even ten years, but it was impossible to conceive the lapse of a period of years in the evolution of the science and technology which served the iron and steel industry. The other day he had been waiting for a member of the Institute in the library at the research laboratory, and he had gone to the bookcase to find a book to read while waiting, and he had taken down the first volume of the Proceedings of the Iron and Steel Institute. He recommended others to read it, as it was very entertaining. He found that in the year in question, 1869, Mr. Menelaus had said: "In England we are met with the difficulty of frequently having to change the section in rolling," and that state of affairs had continued for seventy-one years. One of the major committees operating in this country to-day, however, was doing a great deal to alter that, to the advantage of the country.

The PRESIDENT, having thanked the members, said that the Master Cutler had just entered the room, and he was sure the gathering would wish him to say a few words.

The MASTER CUTLER (Mr. W. Wood) expressed his regret at having been unable to accept the invitation which had been extended to him to attend the luncheon, and also at the fact that, owing to the difficult circumstances of the times, it had not been possible for the Cutlers' Company to offer the hospitality to the Institute that it would in normal times.

AFTERNOON SESSION

The opening session of the meeting was held in the afternoon, when the President occupied the chair.

The PRESIDENT at the outset said that he had a sad duty to perform in referring to the death of two distinguished members of the Institute, Sir Harold Carpenter and Sir Robert Hadfield.

(*Continued on page* 332.)

Electrically-Heated Timber Seasoning Stores

The General Electric Company, Limited, of Magnet House, Kingsway, London, W.C.2, have recently completed the installation of an electrically-operated system for seasoning timber in the stores of the British Northrop Loom Company, Limited, the largest manufacturers of looms in the British Empire. The shop, illustrated in Fig. 1, in which the heaters are situated, was recently built to provide additional storage space required as a result of increased business. It had been the practice of the company to utilise a steam-heating system for seasoning timber, but when unit heaters were introduced to them, it was felt that in the case of the new room the attributes of electric air unit heaters would achieve more efficient and economic results.

It will be appreciated that right from the start a saving was made in initial cost, as the provision of boiler, chimney, piping and other necessary equipment for steam heating was no longer required. Maintenance costs have also been reduced, since no manual attention is needed for unit heaters, while valuable floor space normally taken up by the other type of plant has also been left free for wood storage.

The room in which the heaters are fitted is 36 ft. 5 in. long by 29 ft. wide and 11 ft. 6 in. high, the capacity being 12,280 cub. ft. The walls are of brick and are unlined, the ceiling being of wood with steel girder supports. Three heaters have been used, two being fixed inside the room 9 ft. above the floor, and a third outside in a trunking system. This arrangement (detailed in Fig. 2) allows for the maximum use to be made of the air heated by the inside units, by taking the flow out through ducts in one wall, passing them through the outside unit, which reheats the already warmed air and propels it along the trunking and out through the vents in the centre of the room. A perpetually circulated flow in which there is a minimum heat loss is thus achieved. The valve in the outside trunking allows the hot air to be dispersed into the open, if the wood is very damp and the atmosphere consequently too humid for proper seasoning. Thermostatic control has been adopted, the temperature being maintained at 96 deg. F., which has been found most suitable for hickory, beech and the other hardwoods which are seasoned.

The British Northrop Loom Company, Limited, reports that seasoning has been considerably speeded up, so that, apart from the efficiencies and economies already outlined, this advantage has quickly repaid the foresight shown in its planning. Further unit heaters have also been installed in various workshops of this firm to supplement the general heating.

The heating units used are of the same type as is becoming increasingly popular for the healthy heating of factories.

FIG. 1.—CORNER OF THE WOOD-SEASONING ROOM, SHOWING DISPOSITION OF THE INTERIOR UNIT HEATERS.

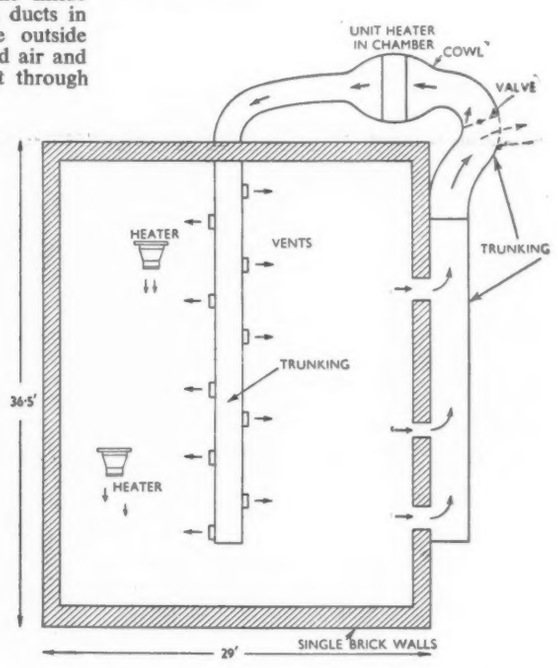


FIG. 2.—PLAN OF WOOD-SEASONING ROOM, SHOWING TRUNKING SYSTEM INCORPORATING EXTERIOR UNIT HEATER.

The Iron and Steel Institute

AUTUMN MEETING AT SHEFFIELD

(*Continued from page* 331.)

Both had been well known to many members of the Institute, and he knew that the sadness felt by the members of the Council at the death of their two distinguished colleagues would be shared by all the members. Both had been Fellows of the Royal Society and men of international reputation in their different spheres. Sir Robert Hadfield needed no words of his in the city of Sheffield, but the members grieved for a great citizen who had been also a great industrialist and discoverer, a man whose name would be remembered as long as Sheffield made steel.

Sir Harold Carpenter had been acknowledged to be the respected head of the metallurgical profession of this country. He had been a careful and accurate investigator, a brilliant teacher, and a most lovable man. It was perhaps not so widely known that his services had been constantly called on by Government authorities when advice on metallurgical problems was required.

Sir Harold and Sir Robert had both served as President of the Institute, and had had the interests of the Institute at heart. Like many conspicuously busy men, they had found time to be the most regular attendants at meetings of the Council and at the Institute's discussions. They had rendered great service to the Institute; the present members were their debtors, and future members would also be their debtors.

He was sure that all present would wish their sincere expressions of regret and sympathy to be sent to Lady Hadfield and to Lady Carpenter, and he would arrange for that to be done.

At the request of the President, the members stood in silence for a few moments.

MR. G. A. V. RUSSELL and MR. W. E. BENBOW were appointed scrutineers of the ballot for the election of new members, and later in the meeting it was announced that all the 144 candidates had been duly elected members of the Institute.

The SECRETARY (Mr. K. Headlam-Morley), in accordance with By-law 10, announced the names of the members of Council retiring in rotation at the next annual meeting, as follows:—*Vice-Presidents:* Mr. Arthur Dorman, Mr. J. S. Hollings and Mr. C. E. Lloyd. *Members of Council*: Capt. H. Leighton Davies, Mr. I. F. L. Elliot, Principal C. A. Edwards, F.R.S., Mr. E. F. Law, and the Hon. R. G. Lyttelton.

Capt. Ablett, who a few years ago had presented a prize of £50 for the best Paper on steelworks engineering by a junior engineer, had now asked that the qualification be extended to apply to any engineer, so that the prize was now open for the best Paper presented at the annual meeting on steelworks engineering.

The PRESIDENT said that the Institute was indebted to Capt. Ablett for that modification. He knew that Capt. Ablett wished the prize to be open to members of the engineering staff of the British Iron and Steel Federation, so the Council hoped to receive some Papers from them that would be interesting and useful.

The meeting then proceeded to a discussion of the Papers.

Effect of Sand on the Physical Properties of Grey Iron*

By H. W. DIETERT and E. E. WOODLIFF

(Abridged)

Those who have cast metals in moulding sand undoubtedly have noticed that the sand exerted a strong influence on the manner in which the metal solidifies in the mould. This influence of sand on the cooling of metal in a mould, both in the liquid and solid states, is due to the heat conductivity of the sand in the mould. The heat absorption of moulding sands varies greatly for the various grades of sands used in the foundry. It also varies due to the condition of the sand as prepared for moulding; for example, variation in moisture. In a search to determine the degree to which the sand influenced the physical properties of a cast metal, a series of tests as described in this Paper was conducted.

Scope

The magnitude of variables that may exist in a mould is so great that to consider all of them at one time would cause one to become lost in a mass of data. In the presentation of this study, so that it will be of practical value, only two mould variables will be considered: moisture and permeability of the sand. The physical properties of the cast metal that were considered are: fluidity, strength, deflection, porosity, feeding, chill and microstructure. The type of metal to be used in the investigation received careful study. It was decided to use a cupola grey iron, because this type of metal would readily reflect any influence due to the rate of heat absorption by the moulding sand. The metal composition used was: Gr, 2.81; C.C, 0.61; T.C, 3.42; Si, 2.08; Mn, 0.79; S, 0.097; P, 0.45, and C equivalent, 4.26 per cent.

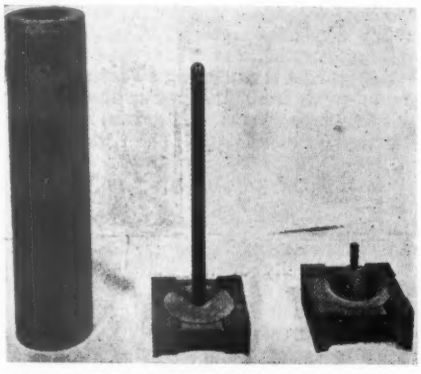


FIG. 1.—PATTERN EQUIPMENT USED TO MOULD 1.2-IN. DIA. TEST-BARS FOR DETERMINING STRENGTH AND DEFLECTION.

Test Equipment

The moulding sands used in this investigation were tested with sand testing equipment built in accordance with A.F.A. specifications. The test patterns used to form the various test specimens for the physical properties of the metal are described in the following paragraphs.

Fluidity.—The fluidity of the metal was determined by using the fluidity test pattern built in accordance with A.F.A. specifications. The mould was made in a snap flask and poured without a jacket.

Test-Bars.—The 1.2-in. dia. test-bars for the strength and deflection tests were poured in moulds in equipment built in accordance with A.S.T.M. specifications, with the exception that a 6-in. dia. pipe was used as a flask to give ample sand around the casting. This equipment is shown in Fig. 1. The transverse specimens were broken on 18-in. supports.

Chill Test.—The chill-test pattern equipment consisted of a box in which a chill wedge step pattern, 2¼ in. wide and 5¼ in. long, was mounted. Across the width of the wedge appear steps ¼ in. wide and stepped $\frac{1}{32}$ in. The box was rammed with sand and stripped, leaving a mould with the impression of the stepped wedge chill specimen. The chill was reported in 32nds of an inch; each step showing white fracture is equal to a chill of 4.

Feeding and Porosity Tests.—The feeding and porosity of the metal was studied with the aid of a "K" test pattern having a 1-in. cross-section. Additional metal was fed through the "K" test mould by attaching an additional bob pattern requiring 3 lbs. of metal. This additional metal caused the "K" test-bar to be more reliable and respond to a change.

Microstructures.—Micrographs were taken from polished and etched sections of the transverse test-bar at fracture and ⅛ in. from the outer edge.

Pouring Test Moulds

Considerable care was exercised in pouring the test moulds to eliminate external variables such as cooling of molten metal or change in metal composition for any given series of moulds. The molten metal for a given series of moulds, for example, those used to determine strength-deflection *versus* moisture, was poured from a 2-ton mixing ladle into a 500-lb. capacity bull ladle. The bull ladle was transferred 30 ft. to the moulds. Two men, each using a preheated 50-lb. capacity hand ladle, poured the moulds, thus reducing time to pour any given series of moulds to within 3 mins.

The data for this investigation are best presented by dividing it into two parts. The first part deals with moisture as the prime variable in the sand, and the second part with the permeability of the sand as the variable.

PART I—EFFECT OF MOISTURE

A group of moulds for the various test patterns was rammed using the same sand, but varying the moisture from zero to heavy tempered sand. The zero moisture-content mould was obtained by baking the moulds in a core oven. The data as presented for this series of tests are data representative of a number of repeated tests. The physical properties of the moulding sand used are tabulated in Table I.

TABLE I.—*Physical Properties of Moulding Sand Used.*

Feel.	Dried mould.	Dry side.	Temper.	Heavy.
Moisture, per cent. ..	0	6.2	6.6	7.4
Permeability	95	89.5	68.0	56.0
Green compression strength, lbs. ..	—	7.2	6.7	5.6
Deformation, in. ..	—	0.017	0.019	0.021
Dry permeability ..	95	99	95	70
Dry compression strength, lbs. ..	76.0	50.0	76.0	90.0
Hardness	—	79	72	68
A.F.A. specimen weight, grams ..	—	165	173	179
Flowability	—	66	66	69
Toughness	—	122	127	118

It may be noted that the green permeability of the sand decreased from 95 to 56 as the moisture content varied from 0 to 7.4 per cent. This reduction in permeability as the moisture increased, reduced the chilling effect of the sand due to the fact that ventilation of the mould was decreased. On the other hand, increasing moisture decidedly increases the chilling effect, the effect being greater in proportion than the opposite effect caused by the decrease in permeability. Therefore, it may be stated that the effects of moisture would have been greater than those disclosed in this investigation had the permeability been held constant.

On the skin of the mould, which is immediately dried on pouring, the dry permeability varies from 95 to 70 as the moisture content changed from temper to heavy temper. If the permeability of the metal-dried skin of the mould is used as a criterion, then the permeability change in this series of tests with moisture as the variable, may be neglected.

Effect of Moisture on "K" Bars.—An examination of the cross-section of the special "K" bars disclosed that the molten metal would feed into a heavy section when the mould was dried, or when the mould was made with a sand of which the moisture content was sufficiently low to give a dry feel to the sand, or when moisture was at temper. Note the feeding of "K" bars at the left-hand of Fig. 2, made in sand with moisture at 0 and 5.1 per cent. The "K" bar made with 7.5 per cent. moisture sand does not show any feeding. It does show a gas blow from the high-moisture sand. The physical properties such as fluidity, strength, deflection and chill in the metal are tabulated in Table II, as obtained from moulds made with sand of different moisture content.

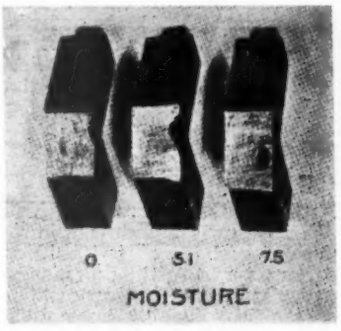


FIG. 2.—THREE "K" BARS CUT TO SHOW EFFECT OF MOISTURE IN THE SAND ON FEEDING OF MOLTEN METAL.

Effect of Moisture on Fluidity.—Through the use of the A.F.A. fluidity test pattern, the effect of moisture in the sand on the fluidity of a metal in a mould was easily obtained. In Fig. 3 is a graphic illustration of the relation between moisture of sand and fluidity of grey iron. The fluidity is little changed by having the moisture at zero or on the dry side of temper, *i.e.*, 0 to 6.2 per cent. moisture showed 26 to 26½ buttons. However, when the sand was tempered at 6.6 per cent. moisture, the fluidity dropped to 14½ buttons. With the sand on the heavy side, having moisture at 7.4 per cent., the fluidity was reduced to 9 buttons, substantially one-third of the fluidity for dry-sand moulds. It may thus be assumed that "misrun" and "cold-shut" casting defects may easily be caused by working sand tempered to the heavy side.

Effect of Moisture on Chill.—Table II shows the relation between moisture of the sand and the chill of grey iron. The moisture-free mould gave a chill of 3½, which was doubled in a mould

* Paper presented to the Chicago Convention of the American Foundrymen's Association. Both authors are associated with the Harry W. Dietert Company, Detroit.

where the sand was at a good workable moisture content of 6.6 per cent. With moisture increased to 7.4 per cent., the chill increased to 12. These data well illustrate how rapidly the moisture of the sand subtracts heat from the metal after it is poured in a mould. Realising that the moisture of the sand materially affects the rate of solidification and cooling of a metal in the mould, leads one to believe that the transverse strength and deflection of a metal is vitally influenced by moisture of the sand. The effect may be studied from the data tabulated in Table II.

TABLE II.—*Physical Properties of Grey Iron as Affected by Moisture in Sand.*

Moisture	0	6.2	6.6	7.4
Transverse strength, lbs.	1,835	1,904	1,969	1,825
Deflection, in.	0.379	0.374	0.368	0.335
Chill in ½ in.	3.5	6	7	12
Fluidity buttons	26	26¼	14¼	9
Metal temperature, deg. C.	1,460	1,460	1,460	1,460

Effect of Moisture on Transverse Strength and Deflection.—The maximum transverse strength was obtained from test-bars moulded with sand at temper of 6.6 per cent. moisture. As moisture content increased from 0 to 6.6 per cent., the strength of the test-bars increased from 1,835 to 1,969 lbs., undoubtedly due to a refinement of grain. The strength dropped to 1,825 lbs. when the moisture of the sand was increased to 7.4 per cent. on the heavy side of temper. The above series of test-bars was made in a relatively open sand with permeability in the 50 to 90 range. A series of test-bars made in a 20 to 30 permeability showed the same characteristics with the exception that peak strengths were usually found in moisture range just ahead of the temper point. Dr. R. Schneidewind, University of Michigan, found that a certain rate of fast cooling caused incomplete pearlite formation with resulting weak ferrite grain. This condition undoubtedly explains in part the low strength of bars cast in high-moisture sand where fast cooling is obtained. Another reason for low strength of bars cast in high-moisture sand is the small gas-hole inclusions in bars cast in that type of sand. In observing the data for deflection, one may note the deflection was reduced gradually from 0 to 6.2 per cent. moisture and then rapidly reduced when moisture was increased from 6.2 to 6.5 and to 7.4 per cent. This shows that the cast metal loses much of its deflection property when cast in heavy tempered sand.

Influence of Moisture on Fracture Appearance.—The fracture of a series of strength test-bars made in moulds of different moisture contents showed that the moisture in the sand influences the appearance of the metal fracture. The fracture of the bars, made in the dried mould, showed a bluish-grey colour with a considerable area, in the centre, of coarser grains. This definitely indicates slow cooling, due to lack of moisture. As the moisture content increased to 7.4 per cent., the fracture became lighter in colour and had decreasing areas of coarse grains.

Graphitic Carbon versus Moisture in the Sand

A variation of moisture will affect the size of graphitic carbon flakes. The graphite formed in a 1.2-in. dia. test-bar, poured in a dried mould with zero moisture, was well precipitated, due to comparatively slow cooling. A test-bar poured in a mould where the sand was tempered with a minimum moisture of 6.2 per cent. showed longer graphite flakes than that of the dried mould. This is due to the slower cooling of metal in the semi-dry sand mould, since sand tempered on the dry side has a lower permeability than a dried mould.

When the test-bar is poured in a mould where the sand was correctly tempered to 6.6 per cent. moisture, the carbon was well dispersed and of shorter flakes than that produced by 6.2 per cent. moisture sand. The graphite produced by a mould made with a sand tempered 7.4 per cent. moisture, and on the wet side, was finely divided, showing rapid cooling.

Microstructure versus Moisture in the Sand

The fields or areas affected the greatest degree by the moisture are the steadite areas. Where the test-bar was poured in the dried mould, or in a mould made with sand on the dry side with 6.2 per cent. moisture, the steadite areas are large. As the moisture is increased to the wet side (7.4 per cent.), the steadite areas

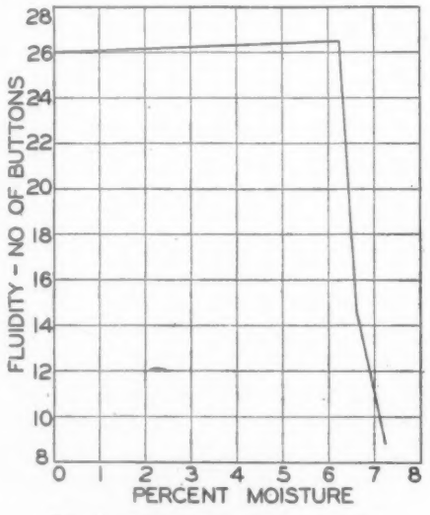


FIG. 3.—EFFECT OF SAND TEMPERING MOISTURE ON IRON FLUIDITY.

become smaller, since they do not have an opportunity to grow, due to the quick cooling of the metal.

The manganese-sulphide crystals do not show any appreciable change in size as the moisture content is varied. The pearlitic fields are of a slightly finer structure as the moisture content of the sand increases. The pearlitic field of the test-bar made in the dried mould shows a much more open structure than bars made in the green-sand moulds.

The ferrite areas increase in size as the moisture content of the sand increases. This is undoubtedly caused by a more rapid setting of the metal as moisture increases, thus causing pearlite to be incompletely formed. This, the authors feel, caused in part the low strength obtained in bars cast in high-moisture sands.

TABLE III.—*Physical Properties of Moulding Sand Used.*

Moisture, per cent.	9.2	6.6	3.6
Permeability	27.3	68	132
Green compression, lbs.	7.4	6.7	7.4
Deformation, in.	0.022	0.019	0.019
Dry permeability	35.2	95	159
Dry compression, lbs.	73.0	76.0	208
Hardness	65	72	75
A.F.A. specimen weight, grams	170	173	170
Flowability	73	66	79
Toughness	162	127	141

The grain size of the metal shows a marked reduction in size as the moisture content is varied from the dry side to the wet side.

PART 2—EFFECT OF PERMEABILITY ON THE PHYSICAL PROPERTIES OF A GREY IRON

The moulds used in determining the influence of permeability on the physical properties of grey iron were made of sands ranging from 25 to 170 in permeability. All moulds were rammed with sand at temper and then baked in a core oven to eliminate moisture, thus largely dealing with only one variable, namely, permeability. The physical properties of the moulding sand are tabulated in Table III. It was found that the permeability of the sand influenced the rate of metal cooling to such an extent that porosity was minimised with high-permeability sand.

Effect of Permeability on "K" Bars.—The examination of the sectioned "K" bars

TABLE IV.—*Physical Properties of Grey Iron as Affected by Permeability of the Moulding Sand.*

Permeability	27.3	68	132
Moisture, per cent.	0	0	0
Transverse strength, lbs.	2,148	2,020	1,978
Deflection, in.	0.414	0.364	0.350
Chill in ½ in.	9	10	11
Fluidity buttons	29	29	25
Metal temperature, deg. C.	1,445	1,445	1,445

revealed that the "K" bar made in 35 permeability sand had a large and deep porous area. The "K" bar cast in 85 permeability sand showed a porous area as large, but of very shallow depth. The "K" bar cast in the 170 permeability sand showed practically no porous area.

Effect of Permeability on Physical Properties

The data tabulated in Table IV cover the physical properties of the grey iron cast in sand ranging from 27 to 132 in permeability. In this series of tests, it was found that the permeability of the sand cooled the metal in a mould by convection. The greater the permeability of the sand, the more free the circulation of gases from the face of the mould to the atmosphere. Thus an increased amount of heat would be carried off as the permeability is increased. This explains the reduction of porosity of "K" bars as the permeability increased.

Fluidity.—Should this assumption be true, then an increase in permeability may actually reduce the fluidity of the metal in a mould, providing mould gas pressure is equal. The fluidity data, Table IV, indicate that the fluidity may be reduced when permeability of the sand is much in excess of that required. At 132 permeability, the A.F.A. fluidity test pattern shows a fluidity of 25, against a fluidity of 29 at 27 to 68 permeability.

Chill Tests.—Another good check on how permeability cools a metal is obtained from the chill test. (See data in Table IV.) The chill was increased from $\frac{3}{16}$ to $\frac{11}{16}$ in. as the permeability was increased from 27.3 to 132. This difference in chill is not as great as was experienced with a change in moisture. Thus, it may be assumed that moisture affects the cooling rate of a metal more than a change in permeability.

Transverse Strength and Deflection.—This study may be continued by observing the effect that permeability has on the strength and deflection of grey iron (see Table IV). The strength of the metal decreased from 2,148 to 1,978 lbs. as the permeability increased from 27.3 to 132, while the deflection decreased from 0.414 to 0.350 in. The deflection decrease is readily understood as caused by a more rapid cooling of the metal as the permeability is increased. The explanation of the weakening of the metal as permeability is increased may be ascribed to the undercooling phenomena. Slow cooling, as obtained by low permeability, allows sufficient time for the pearlitic structure to form completely, resulting on a strong grey iron. In fast cooling, as obtained with 132 permeability sand, the pearlite does not have sufficient time to form completely, resulting in large weak

ferrite areas. A study of micrographs substantiates this theory. It is interesting to observe the fracture of strength test-bars, noting the bluish-grey fracture for the bar cast in 27.3 permeability sand. When permeability is increased to 68, the fracture becomes much lighter in colour. The fracture of the bar cast in 132 permeability sand is very light and of fine grain.

Graphitic Carbon versus Permeability of the Sand

The rate at which a casting cools is affected by the permeability of the sand in that heat is carried from the metal by gas-flow from the face of the mould to atmosphere. The magnitude of this cooling effect was well demonstrated micrographically. The graphite flakes in the metal poured in the 27.3 and 68 permeability sands are coarser than that of the metal poured in a sand of 132 permeability. A comparison between the graphite of bars made in 27.3 and 68 permeability showed that the 27.3 permeability sand produces practically all coarse graphite flakes, while the 68 permeability sand produced both coarse and fine graphite.

Microstructure as Affected by Permeability

The permeability of the sand affects the rate of cooling sufficiently to show a distinct change in the pearlite, ferrite and steadite fields, and in grain size. A micrographic study revealed that the steadite areas are reduced considerably as the permeability of the sand is increased from 27.3 to 132 due to an increase in the cooling rate of the metal.

Ferrite areas of appreciable size are produced by the fairly rapid cooling of the 132 permeability sand, which prevents complete formation of the pearlite. This is possibly a good explanation for the decrease in strength of the test-bars as the moisture increased. Probably the greatest change in the metal was noted in the grain size. For example, the grain size of the metal poured in 132 permeability sand is very small, while the grain size of the metal poured in sand with 27.3 permeability is very much coarser. Micrographs clearly demonstrated the refinement of grain and graphite as permeability of the sand increases.

Conclusions

The authors appreciate the fact that there are other variables than moisture and permeability of the sand in a mould that affect the rate at which a metal cools in a mould. However, they do believe that the moisture and permeability are two very important properties of a sand that materially affect the physical properties of a cast metal. The data for fluidity, chill and grain size, as presented herein, may be applied to practically all cast metals.

The findings concerning strength and deflection or ductility may be applied in principle when one knows the effect of rapid cooling on his particular metal. Without question, the strength and deflection trends may be reversed for certain irons of composition different from that used in this investigation. The results of this investigation may be summarised by the following statements:—

(1) Moisture in a sand when at or above temper will reduce the fluidity of a metal.

(2) The feeding of a metal may be greatly retarded by excessive moisture in a sand. Maximum feeding is secured in a dried mould.

(3) Both the transverse strength and the deflection of a grey iron, of similar composition as used in this investigation, are reduced by an excess of moisture of the sand. Moisture will affect the strength and deflection or ductility of many metals.

(4) The fracture of a grey iron becomes finer in structure and lighter in colour as the moisture increases.

(5) The graphitic carbon is refined by an increase of moisture in a sand.

(*Continued at foot of next column.*)

(6) The steadite grain is reduced materially in size by an increase in the rate of cooling as secured with an increase of moisture in the sand.

(7) The ferrite areas for grey iron of the composition used increased in size when moisture was high in the sand, causing a decrease in strength of the metal.

(8) High moisture content of the sand also tends to lower the strength due to gas inclusions of small size found in test-bars cast in heavy tempered sands.

(9) Moisture of the sand has a very great influence on the physical properties of a casting.

(10) The porosity of a casting may be minimised by increasing the permeability of a sand, providing the mass of metal is not too great.

(11) The fluidity of a cast metal may be reduced by using a sand with excess permeability.

(12) The chill of a grey iron is increased with an increase of moisture in the sand.

(13) The fracture of a grey iron becomes finer and lighter in colour as the permeability increases.

(14) The graphitic carbon is refined considerably as the permeability of the sand is increased.

(15) The areas of steadite are reduced in size by an increase of permeability of the sand.

(16) The pearlitic areas are more completely developed for low-permeability sands.

(17) The pearlite areas are incompletely developed with increased areas of ferrite when permeability is high for a particular section of metal.

(18) The permeability of a sand will exert a noticeable influence on all physical properties of a casting.

(19) Considering a practical range of moisture and permeability for a casting, it may be stated that moisture in the sand has greater influence on the physical properties of a casting than permeability.

Tinned Piston Rings

CHEMICAL PROCESS APPLIED TO CAST IRON

The use of tinned pistons greatly assists in reducing the extent of the wear that is apt to occur when a new engine is being run in. It is nine years since the idea was introduced by one of the largest automobile groups in the U.S.A., who used a million tinned pistons in the following twelve months, even although in order to do so a change-over from aluminium to cast iron as piston material was necessitated. Later, a satisfactory process was developed for applying the tin by chemical ("displacement") tinning to aluminium pistons, and this process is now in very general use by the largest makers both in Europe and America.

It was evident that similar advantages ought to result in the case of piston rings, but for some time attempts to produce satisfactory tin coatings on these components were not successful. The problem has, however, been solved and a number of firms are now tinning piston rings. The Light Production Company, of Slough, has accorded permission for publication of the following notes on their method of coating the rings.

The rings are produced from a special quality of cast iron having the desired physical structure and properties. They are ground accurately to size, making an allowance for the thickness of the tin subsequently applied. This operation, it will be seen from Fig. 1, leaves the periphery of the ring with a surface that is composed mainly of disturbed and flowed material which is very liable to become detached and cause wear. The next operation is to remove any grease from the rings in a hot alkaline bath; they are then etched in an acid bath. After this treatment the surface of the rings is seen (Fig. 2) to be free from *débris* caused by grinding and to contain small hollows or depressions. The rings are now washed thoroughly and transferred to an electro-tinning bath of the alkaline stannate type and given a coating of 0.0005 in. (0.012 mm.) of pure tin; the rings are washed and dried and are then ready for use.

The pitted structure of the tinned surface has a number of advantages, chief of which is that it assists in retaining the lubricating oil on the ring during the formation of the so-called Beilby layer. The tin coating is sufficiently plastic to flow under the points of greatest pressure and thus prevents scuffing while the surfaces are "running-in" and forming the Beilby layer. The combination of the hard network of iron phosphide with a plastic metal like tin forms a very close resemblance to ordinary bearing metals in which relatively hard particles are embedded in a softer matrix.

Examination shows that the surface of a tinned piston ring is rapidly run in and quickly develops a lubricant-carrying surface without risk of damage to the cylinder.

FIG. 1.—PHOTOMICROGRAPH OF PERIPHERY OF CAST-IRON PISTON RING AFTER GRINDING TO SIZE, SHOWING DISTURBED CONDITION OF THE SURFACE. × 90.

FIG. 2.—THE SAME SURFACE AS FIG. 1 AFTER ETCHING. × 90.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Foundry Progress in Hong Kong

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Having read with great interest Mr. Button's Paper on "General Steel Foundry Practice," particularly with regard to his references to the Far East, the writer feels that a brief outline of the progress that has been made in Hong Kong within the last few years may be of general interest.

The foundry which the writer controls has a battery of acid electric furnaces. These furnaces are in daily operation. A considerable variety of carbon and alloy steel castings is produced, predominant amongst which are marine castings such as stern-frames, rudder frames and propeller brackets, machined to Admiralty, Lloyd's and Board of Trade requirements.

Another important product is that of carbon and high-tensile steel ingots, tests from the latter being of the order of 47 tons' tensile with 25 per cent. elongation.

Chrome-molybdenum steel cylinder heads and piston crowns are now being successfully made, whilst Diesel pistons and cylinder liners of superheated nickel-chrome iron are yet another product of these furnaces. Appended is a selection of photographs of a few typical castings recently made in this foundry.

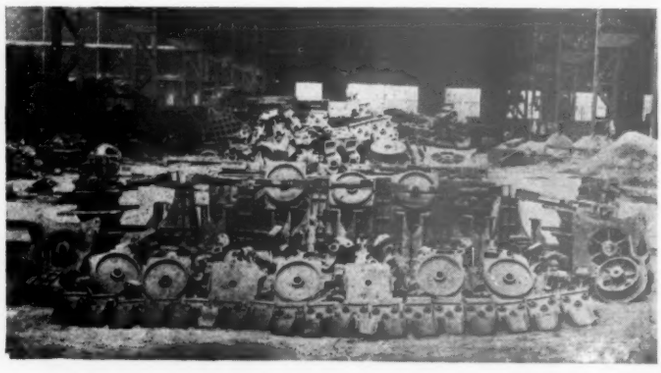
Incidentally the Chinese themselves have not been slow in taking advantage of these modern methods of production, and at least two Chinese-owned and controlled ironworks here have installed small electric melting units within the past few months, but up to the time of writing they have not got into the regular production stage.

From the above remarks and photographs the writer feels sure that Mr. Button will appreciate the progress that has been made since the times he recalls; also that the Empire in general will realise that Hong Kong itself has not been lacking in initiative as far as steel production is concerned.—Yours, etc.,

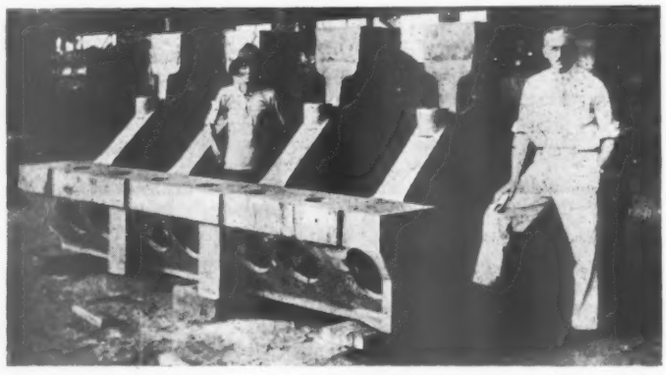
P. B. PARKS

(Chief Metallurgist and Foundry Manager, Hong Kong & Whampoa Dock Company, Limited).

Hong Kong.

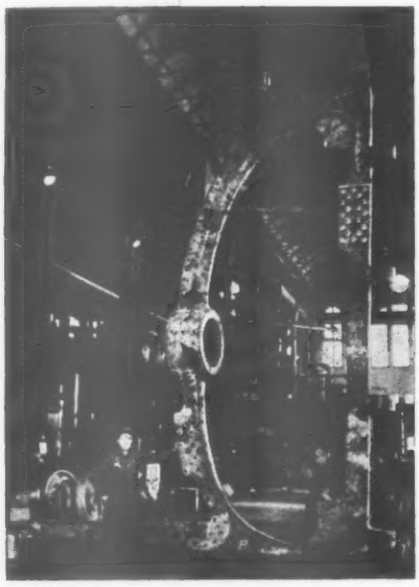


STEEL CASTINGS FOR RAILWAY ROLLING STOCK.

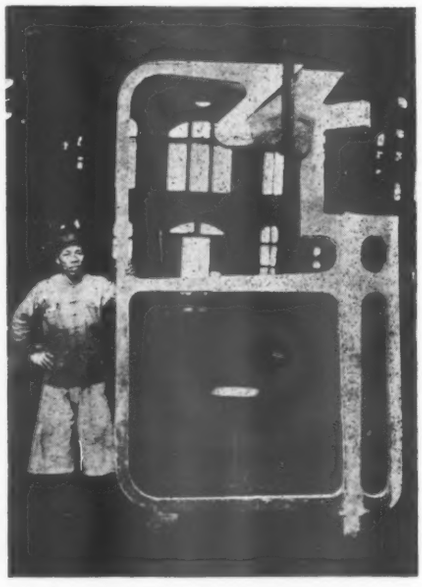


DIESEL ENGINE BED, CAST FROM ELECTRIC-FURNACE SUPERHEATED CAST IRON.

DIESEL CYLINDER LINER CAST IN NICKEL-CHROME CAST IRON.



CAST STEEL STERN FRAME YIELDING 30 TONS TENSILE, ASSOCIATED WITH 37.5 PER CENT. ELONGATION AND 120-DEG. COLD BEND.



CAST STEEL RUDDER FRAME.

Copper-Bearing Steels

DR. L. REEVE, in a Paper entitled "The Corrosion of Mild and Copper-Bearing Steel Panels in Iron-Ore Wagons," which has been accepted for presentation to the Iron and Steel Institute, has summarised his survey of the subject as follows:—The losses in weight of a series of mild-steel and copper-bearing (copper 0.38 per cent.) mild-steel test panels fitted in the end plates of three 21-ton steel iron-ore wagons have been compared over a period of nearly three years. The panels weighed approximately 40 lbs. each, and were bolted into steel frames welded on to the end plates, so that each wagon carried a plate of each kind of steel. The panels were weighed at approximately six-monthly intervals after scrubbing with a dry wire-brush. The weight losses are tabulated and are shown graphically. The results indicate that at the end of approximately three years the average loss in weight of the copper-steel panels amounts to only 38 per cent. of that of the mild steel, and that it is getting relatively even smaller. The loss in weight is due to a combination of corrosion and mild abrasion by the masses of iron ore. It is probable that the good result given by the copper-bearing steel is partly due to the fact that the scale on the latter is tightly adherent to the underlying plate, and exerts a certain amount of protective action upon it. There would appear to be little doubt of the economic value of using copper-bearing mild steels in the construction of wagons of the type described.

Casting Defects Common to Motor-Vehicle Grey Iron

THEIR IDENTIFICATION, PROBABLE CAUSE AND CONTROL

By W. B. McFERRIN

(*Continued from page* 321.)

Defects Due to Core Conditions.—If blows are due to conditions such as *a*, *b* or *d*, under "Core Blows," the blow shows up as a depression on the inner surface of the casting, as a hole through the wall of the casting, or as trapped gas in a heavier section, with a worm hole or spongy section leading from the cavity, due to trapped gas, to the surface of the core. It will also be noted that metal did not lay firmly against the cored surface, but did against the mould surface, except for the area directly over the defect. It is then necessary to check the records of core sand mixtures, baking temperature and time to determine which of the above three variables was at fault. *Correction*—if *a* be the defect, use less binder; if *b*, increase baking time or temperature; or if *d*, reduce the coal-dust content.

If the core blow be due to either *c*, *e* or *f*, the defect will make its appearance in the form of a depression, blowhole, or trapped gas pocket above or in the line of flow of the metal from that part of the core causing the defect. The location of the defect and the appearance of the cored surface in the vicinity of the defect will indicate which of the above three is at fault.*

To determine if the defect was due to *g*, it will only be necessary to check the records of core sand mixtures, baking time and temperature, and correlate this information with the appearance and location of the defect. The correction is the use of finer sand.†

7.—Cuts and Washes

Defective castings that are due to cuts and washes will have rough lumps of metal, or rounded corners which should be sharply defined, or at other points, along the line of flow of metal, there will be rough granular depressions or holes.

Probable Causes

The probable causes for this defect are:—(*a*) Soft ramming; (*b*) low moisture; (*c*) low green strength (low dry strength); (*d*) improper gating; and (*e*) type of clay bond used.

Determination of True Cause and Correction

If the cut or wash is due to *a*, the casting will probably show signs of a swell (casting not true to pattern, showing deformation due to displacement of sand by the metal) in the vicinity of the defect. *Correction*—increase the amount of ramming.

If *b* or *c* be the cause, then check sand test records, and if either moisture or strength be low, make the necessary corrections, *i.e.*, increase the moisture or clay additions to the sand. If *e* be causing the defect, the latter will probably be in the vicinity of the gate or part of the sand around the gate may be cut or washed away. This may be due to (1) the gate being designed so as to produce a nozzling effect; (2) the arrangement of gates, as for instance, gating into a casting so that a large volume will have to flow over sharp corners or projections of the mould face; and (3) the metal being poured from too great a height directly into the sprue.*

8.—Rat-Tails (Buckles) and Scabs

In the author's opinion, "rat-tails" and "buckles" are one and the same defect in that they are caused from the sand having its expansion too high. "Rat-tails" (small buckles) are produced when the condition of the sand, pouring temperature of the metal and section thickness of the casting are such as to cause enough expansion in the mould face to make a small ridge of sand on the mould face which produces a defect on the surface of the casting, having the appearance of a place where a rat has dragged its tail. If, however, conditions had been such as to produce enough expansion of the sand to cause the mould face to buckle, then the resultant defective casting would be classified as a "buckle."

The author has seen "rat-tails," "buckles" and "scabs," all on the same casting. The casting was a flat plate of about 18 in. dia. and 2 in. thick, gated to pour in 16 to 18 secs. The "buckles" and "scabs" were on the cope surface of the casting and in the vicinity of the gates. The "rat-tails" were also on the cope face of the casting, but on that part of the surface farthest from the gates.

Identification

"Rat-tails" (small buckles) are those defects on the flat surfaces of castings that have the appearance of a ridge, the top of which is slightly above the normal surface of the casting. One side of the ridge gradually slopes back to the normal surface of the casting, with the other side dropping off suddenly to slightly below and then sloping gradually up to the normal surface of the casting. Scabs are those rough spots, usually on a thick-walled portion of the casting, the wall being slightly thicker than normal, porous and containing a layer of sand underneath the surface of the rough spot. Scabs are generally more numerous on the surface of the casting in the vicinity of the gates, or on the surface of heavy-walled castings where the sand is heated sufficiently to contract.

Probable Causes

According to Dietert and Valtier[7]† "rat-tails" occur in lightweight castings where the temperature of the sand does not reach contraction point, but sufficient heat is present to expand the sand. Another quotation from the same Paper, as to the cause of the scab, states: "The combination of excessive expansion and contraction, as obtained when sufficient weight of molten metal is present to raise the temperature of the sand to contraction point, is undoubtedly the best explanation of the direct cause of a scab."

Some of the causes of rat-tails and scabs are as follow:—(1) Hard ramming; (2) low permeability (sand contains too much fines); (3) high moisture; (4) high strength; (5) low coal-dust content, and (6) change in type of clay used.

Methods of Correction

According to the previous reference, "Expansion of moulding sand may be reduced by (*a*) increasing grain size, (*b*) reducing fines, (*c*) addition of combustible materials, (*d*) reducing the mould hardness, (*e*) increasing permeability, and (*f*) reducing moisture." Opposing stresses between expansion and contraction may be reduced by (*a*) increasing grain size, (*b*) reducing the fines, (*c*) reducing mould hardness, (*d*) increasing permeability, (*e*) reducing moisture, and (*f*) reducing clay content.

9.—Drops, Rats, Crushes

Defects of this type are easy to distinguish from other defects. A defective casting due to a "drop" will have a large rough lump of metal protruding above the normal surface of the casting, under which, in some cases, will be a sand pocket. In other cases, it will occur along the line of flow of the metal. Defects classified as "rats" by some foundrymen are those due to part of the mould face sticking in a pocket on the pattern, or dropping off before the drag was placed on the conveyor, or before the cope was placed over or on drag. Defects classified as crushes are those castings showing deformation along the parting line or around core prints.

Probable Causes

Some of the causes for defects classified as drops and rats are:—(1) Low green strength; (2) low or high mould hardness; (3) insufficient draft on the pattern; (4) moulding machine draws too fast; (5) pattern loose; (6) bearing surfaces of the flask or pattern worn or not properly cleaned, which causes the flask to rebound when rammed on the jolt machine; (7) worn bumping pad on the moulding machine.

Some of the causes for defects classified as crushes are:—(1) Low green strength; (2) core print too large for the print on the pattern; (3) poor closing conditions; (4) mismatched cope and drag patterns; (5) worn patterns and core boxes; (6) pattern incorrectly mounted; (7) core print too small for the size of core; (8) improper clamping of the mould; (9) use of weights that are too heavy; (10) worn stripping plate on moulding machine, and (11) improper bedding of moulds on bottom plates or boards.

True Causes and Corrections

To establish the true cause and correction for any of the above-mentioned defects will require close observation on the part of an experienced foundryman and correlation of these observations with the conditions of the moulding sand, cores, etc.

10.—Swells

Defects classified as swells occur in those castings which show deformation due to displacement of the sand by the metal.

Probable Causes

Some of the conditions causing these defects are:—(1) Soft ramming; (2) mould not properly bedded on to the bottom plate, and (3) flasks not rigid or not containing enough bars (supports for the sand).

Method of Correction

The true cause will be easy to identify upon close examination of the defective casting and observation of moulding practice. The correction will then be obvious.

11.—Sand Inclusions

Sand inclusions in castings are those cavities of irregular shape and size, the inner surface of which plainly shows the imprint of a granular material around which metal would flow.

Probable Causes

The probable causes of sand inclusions are as

* An improperly placed vent, or a vent that is not properly taken off through a mould, does more harm than no vent at all.

† The explanation of a blow due to high permeability is that the heat from the metal will penetrate a highly permeable core at a much faster rate than it will one of low permeability. In other words, the rate of gas evolution from any particular core (the binder content, baking temperature and time being the same), which is exposed to the same heating conditions, will vary according to permeability.

* A pouring basin or cup should be large enough to permit the metal pourer quickly to choke the sprue without pouring directly into the sprue, or splashing metal all over the top of the mould. The down sprue should have a cross-sectional area slightly larger than the combined cross-sectional area of the gates, but less than the cross-sectional area of the runner. The width of the runner should be less than its height. The gate should be flat and slightly wider at the junction of the gate and the casting than at the junction with the runner. If all the other factors mentioned above are correct, then the defect is probably due to *e*, especially if the source of supply of the bonding clay has changed and the new clay gives much lower dry strength than that used formerly.

† See references at end of last week's instalment, page 321.

follow: (1) Poor moulding practice (carelessness); (2) cuts and washes; (3) crushes; (4) improper gating, and (5) sand incorrectly conditioned.

It has been the author's experience that, in the majority of cases, defective castings due to sand inclusions were the direct result of inefficient moulding practice, such as (1) blowing off pattern into unclosed drag; (2) loose sand falling into the drag from overhead equipment, moulders' clothes, outside edges of cope flask, etc.; (3) loose sand in the pouring basin or sprue; and (4) blowing loose sand out of the sprue and pouring basin (while the cope is resting on the stripping plate of the moulding machine after drawing the pattern) with the high-pressure air line in such a way as to cause loose sand to hit the pattern and rebound and stick on to the cope surface of the mould.

12.—Shifts (Cope, Drag and Core)

A shift is indicated in castings in which the cope and drag portions do not exactly match at the parting line or when one wall of a casting containing a cored cavity is thinner and the other wall is heavier than called for by the specification. The former is a mould shift; the latter is a core shift. That portion or section of a casting improperly located, which was formed by a core, is also known as a "core shift."

Probable Causes

The probable causes of shifts are as follow:—(1) Worn pins and bushings; (2) cope and drag pattern not exactly matched; (3) improper clamping in conjunction with loosely fitting pins and bushings; (4) rolling weighted moulds on a gravity conveyor; (5) cores set incorrectly, and (6) lack of ample core prints or chaplets.

Methods of Correction

The true cause will be apparent upon close examination of the defective castings, moulding equipment and practice, core equipment and practice. The correction then will be obvious.

13.—Not True to Pattern

When a casting is not true to pattern, this defect may be due to three classes of causes, namely: (1) those causes which produce a variation in wall thickness; (2) those which cause variations in overall length and width, and (3) those due to the methods used. The following are the definitions of these major classes of causes, the reasons for their occurrence and methods of correction.

Variations in Wall Thickness—Probable Causes

The probable causes of this defect are as follow:—(1) Worn core boxes or patterns; (2) too much rapping of the pattern or core box before or while drawing; (3) cores not true to boxes (*a*) due to not using driers (supports) for certain parts of the core to prevent sagging while baking, and (*b*) rough handling; (4) pattern not properly mounted; (5) springing of the pattern; (6) cores not properly jigged, gauged, and assembled, and (7) cores set incorrectly.

Variations in Overall Length and Width—Probable Causes

The probable causes of this defect are as follow:—(1) Excessive rapping of the pattern; and (2) metal shrinkage and contraction not uniform.

Methods Used—Probable Causes

The probable causes of the defect under this classification are as follow:—(1) Excessive tumbling, shot blasting or grinding; (2) sagging of casting (*a*) due to being shaken out too soon, and (*b*) casting not properly supported while being heat-treated; and (3) warping (see "Contraction Defects," Category No. 1).

Methods of Correction

The determination of the true cause and correction will require detailed examination of the defective casting or castings, and the correct correlation of this information with those probable causes mentioned above that might produce this defect.

14.—Runouts

Defective castings due to runouts are those castings lacking in completeness due to molten metal leaking out of some part of the mould cavity while pouring or after pouring is completed.

Probable Causes

The probable causes of this defect are as follow:—(1) Soft ramming between the mould cavity, sprue or runner, and the edge of flask; (2) mould not properly bedded; (3) improper clamping; (4) bearing surfaces for the flask on the pattern worn or not properly cleaned; (5) sand or metal on the joint of the flask; (6) warped flask; (7) flask too small for the size of casting; (8) sprue too near the side, or the runner too near the joint of the flask; and (9) large core or mould vents too near the surface of the core or the mould cavity, especially if the vents are taken off through the sides of the flask or the bottom plates.

Methods of Correction

The correction will be obvious when the true cause of the runout is found from observation. It has been the author's experience that the majority of the defective castings caused by runouts are due to carelessness.

15.—Rough Castings

The term "rough castings" has a rather wide and varied meaning. What may be classified as a rough casting for one job may be classified as a smooth surface for another, for instance, the surface of a casting that has to be enamelled in comparison to that of a flywheel. The term "rough casting," as used here, will be construed to mean those castings having surfaces so rough that they are unsuitable for the purpose intended, unless extra cleaning or polishing operations are performed on them.

Probable Causes

The probable causes of rough castings may be classified as follow:—*Condition of Moulding Sand and Mould*: (*a*) High moisture content; (*b*) high permeability; (*c*) low flowability—(1) high strength, (2) low moisture content, and (3) sand containing lumps of coal, slag, metal, cores, etc.; (*d*) sand too low in coal-dust content; (*e*) hot sand; (*f*) low mould hardness; (*g*) mould cavity not correctly sprayed or coated; (*h*) pouring temperature too high for moulding materials used; and (*i*) improper gating. *Condition of Cores*: (*a*) Sand too coarse; (*b*) baked too rapidly; (*c*) soft rammed; (*d*) cores incorrectly sprayed, dipped or coated; (*e*) type of coating (core-wash or blacking) used; and (*f*) pouring temperature too high for core materials used.

Determination of True Cause and Correction

Rough Surface due to Condition of Moulding Sand and Mould.—If the rough surfaces be caused from *a*, *b*, *d*, *e* or *f*, or any combination of them, the surface of the casting will probably be uniformly rough. To determine which of the above are at fault, check the sand test records. If moisture, permeability and strength be correct, and the surface of the casting has a dark bluish-grey tint, then the rough surface of the casting is due to hot sand sticking to the pattern. *Remedy*—reduce the temperature of the sand by a better method of aerating or increasing sand storage.

If this method be too expensive for volume or production, then arrange to heat up the patterns to slightly above the temperature of the sand.* Another alternative is to spray the pattern lightly with a mixture of one part of lard oil to ten parts of kerosene (by volume) after every second or third mould. This will eliminate this condition, providing there is not too much difference between the temperature of the sand and the pattern.

If moisture be too high, the surface of the casting may appear the same as that described for hot sand, excepting for small depressions on the cope surface of the casting typical of high moisture blows (see "Blows," No. 6). *Remedy*—reduce the moisture content.

If the permeability is found to be too high upon examination of sand test records, the remedy is to reduce the permeability by the addition of a finer sand or else reduce the coarse grains. In most cases, for quick results, it is cheaper to add a finer sand, being careful to add it in such a way as to have it uniformly distributed throughout the system.

If *d* is at fault, the surface of the casting will be uniformly rough and not have a dark bluish-grey tint, or at least that portion of the surface of the casting corresponding to that part of the pattern that was covered with sand of too low a coal-dust content. *Remedy*—increase the coal-dust additions.

If *f* is at fault, the surface of the casting, in addition to being uniformly rough, will probably show signs of a "swell." *Remedy*—increase the mould hardness.

If *c* is at fault, the surface of the casting will have a rough projection of metal protruding from it. *Remedy*—increase the flowability of the sand, which will eliminate the voids in the mould face.

Cause *g* will only be responsible when the surface finish of the casting is dependent upon some coating that is either sprayed, brushed or dusted on the mould face. Examine the surface of the casting and the coated mould face to determine if it is the type of material used or the method in applying it that is at fault. *Remedy*—determine by experiment the correct material and method of applying it.

If *h* is at fault, the casting surface will have a rough, sandy, burnt appearance. *Remedy*—use materials in the construction of the mould that have higher sintering points, or reduce pouring temperatures of the metal. The author prefers to pour the metal hot (greater than 1,425 deg. C.) and use materials in the construction of moulds and cores to withstand it.

If *i* is at fault, the surface of the casting will show signs of "cutting" or "washing," or have a rough sandy appearance in the vicinity of the gates. *Remedies*—see "cuts" and "washes" (No. 7) or *h* above. This defect, in some cases, can best be corrected by changing gating practice so as not to overtax the sand in the vicinity of gates.

Condition of Cores.—If *a* is at fault, the cored surface of the casting will be uniformly rough. *Remedy*—use finer sand or else coat the surface of the core by dipping or spraying in a core wash. The best wash for any particular job only can be determined by trial and error method or past experience.

If *b* is at fault, the cored surface of the casting will have fins protruding from it. This condition may be due to either too rapid baking or using sand that had too high a rate of expansion and contraction. To determine which, examine the surface of cores after baking. If the surface of the cores is cracked, then *b* is at fault. *Remedy*—use a lower baking temperature.

If *c* is at fault, the surface of the core will contain voids and the cored surface of the casting will have rough projections or lumps of metal on it. *Remedy*—ram the core harder.

If *d* or *e* is the cause, the remedies are the same as those discussed for *g* and *h* under conditions of moulding sand and mould.

If *f* is at fault, the cored surface of the casting either will show signs of "cuts" and "washes" or a burnt-in or sandy appearance.

(*Continued on page* 342.)

* Hot sand does not stick to a pattern made of cast iron or brass as much as it does to one made of aluminium.

The Metallurgical Observer

"The Metallurgical Observer" was the subject of an address given at the opening meeting of the session of the Sheffield Society of Engineers and Metallurgists by MR. N. H. BACON, of Messrs. Steel, Peech & Tozer, Limited.

Introducing his subject, the speaker said that, in the works with which he was associated, the observation and recording of the details of operation had been going on for some years, and during the last two decades the men performing these duties had been gradually welded into an organised body still capable of further development. Some ten years ago the observer was unattached to any particular department, but contacted closely with the melting shops, mills, forges, research departments and laboratories, and from time to time visited customers to investigate complaints or peculiarities and give technical advice or direction. Not being burdened with departmental responsibilities, he was able to carry out a certain amount of investigatory work and make suggestions for improvements in one direction or another.

Founding the Metallurgical Department

At one time the speaker was asked by the works manager to take two assistants, of his own choice, and tackle certain problems which were outside the scope of any particular department. These problems included, amongst others, the development of a better quality of free-cutting steel; the reduction of ingot mould consumption; and an improvement in the quality of the billet leaving the works, a billet which the re-rollers accepted with good grace, but which was not greatly sought after by drop forgers or bright drawers. That was the start of what was to become known as the metallurgical department.

There were, at that time, staff men as casting-pit foremen; these men had had their early training in the general laboratory, and subsequently in the melting shop. They observed the casting of the steel, seeing that pits were set to time, slag holes got ready, moulds bricked, etc. These men were assistants to the melting-shop manager. One shop was shut down for a time, and it was decided to take the men engaged on these duties and employ them on shifts about the mill, observing and recording the behaviour of the steel.

Some time after, the metallurgical department staff was strengthened by more men in this way: the melting-shop manager invited the works metallurgist to take over three pit-side observers, as he thought this would result in more careful observation and recording of the casting practice. These men were not very pleased with the move at the time; they were apparently leaving a definite position and joining a department which appeared at that time to be somewhat nebulous.

Departmental Liaison

Now that observation was being carried out both in the melting shop and mill, by an independent department, the system of recording the results was revised in order that the melting-shop manager should have news, as quickly as possible, as to the behaviour of the steel in the mill, and in such a form that statistical examination could be easily made. The system was modified and added to from time to time as experience was gained.

The position now is that, when a cast is teemed, the pit-side observer fills in a record, which has two tissues attached. The card contains the following details:—The steel quality, type of brick top, method of pouring, number of moulds in each group and teeming times, etc. A small sample is caught from the ladle after each group is filled. This is allowed to solidify quietly and the appearance is noted, whether it pipes, remains flat or works. This is an excellent indicator of the condition of the steel.

Graduating Aluminium Additions

It may be noted, continued the speaker, that the aluminium addition made to the steel during teeming is not constant throughout, but is increased as teeming proceeds; 3 ozs. per ton to the first and second groups, and 4 ozs. per ton to the third and fourth groups. Then there are the general remarks of the observer as to the behaviour of the metal during teeming. The card carries two signatures, those of the melting-shop shift superintendent and the metallurgical observer testifying that the cast in question is up to the standard of quality considered necessary for the type of steel in question. One copy goes to the melting-shop manager, one copy to the metallurgical department, and the card itself goes forward with the ingots to the mill observer. If the cast is in any way not up to specification, the casting-pit observer stamps all three copies "Cast or part cast not satisfactory. Make further inquiry." This gives the mill people ample time to find some suitable outlet for the steel. These data are then amplified by a report by the observer in the rolling pulpit. This rolling report is sent to the melting shop immediately the cast is rolled, so in some cases the men who have made the steel know, before they have finished their 8-hr. shift, how a cast made by them has behaved. In addition to the rolling report, samples are taken from every other ingot rolled, and these are upended while still hot. These upend tests disclose cracks or seaminess very clearly. In this way the melting-shop manager and his staff receive prompt news as to the progress of each cast made.

Working Arrangements

Owing to the observers being in the one team nowadays, it is possible to move them around from one department to another, and so the observer spends alternate weeks in melting shop and mill. This enables him to link up the defects observed in rolling with the practice observed in the casting pit. When he is studying the steel poured, therefore, his vision does not end with the ingot, but in his mind's eye he can picture the nature of billets or blooms which will result from a particular cast.

In pouring steel much depends upon the human element; there are quite a number of points to be watched, and it was noticed that some teemers and pitmen excelled in some of these points but were inferior in others. In order to help carry the good practices from one shift to another, and to give the observers a wider experience, the practice of the observer always working with the same shift of men was dropped. The observers started to change shifts in reverse direction to the men. This enabled them to discover the merits and demerits of the other two shifts. They are able to note how a greater number of men tackle the various jobs around the casting pit, and this added experience makes them more valuable as observers.

In addition to the variety which arises due to working with a fresh team of men each week, and to working alternate weeks in melting shop and mill, they work one month in turn from 9 a.m. to 5 p.m. attending to the testing of free-cutting steel, etc. This month affords a break from shift work, and enables them to get a more general view of the various problems engaging the attention of the department.

The success of such a department depends largely upon the energy and keenness of every individual member of the team, and they must look upon the works as a huge laboratory, where every operation presents a field for research.

The staff of the department was further enlarged when the works entered upon the manufacture of armament steel. The three observers at the acid shop were transferred to the department, and three men were put on to follow the progress of the steel in the presses, hammers and machine shops. This further absorption of departmental observers enabled the policy of changing men about from time to time to be extended.

Wider Individual Scope

Since the men in the department carry on their work, in both the acid and basic melting shops, and the various rolling mills and forges, they have excellent opportunities of increasing their knowledge and experience, and so preparing themselves for a better position. The first assistant devotes his attention, more particularly, to the acid melting shop and the press, forge and machine shops, and has with him six men on shifts, three in the acid melting shop and three following up in the manipulating departments. The second assistant devotes his attention more particularly to the basic melting shop and the rolling mills at Templeborough. He has with him six men on shifts, three in the melting shops and three in the mills.

Obviously the metallurgical department of itself could achieve but little. It is a service department which provides information to the various departmental managers, and, as the result of collecting and examining data, is able from time to time to proffer advice or suggest modifications in practice. It is a department which also depends for its success upon the co-operation of the general laboratory, the research department and the inspection department. So, now, when dealing with some of the work which has been accomplished, it must be understood that the results achieved are not due to the metallurgical department alone, but are due to the co-operative effort of many workers in numerous departments.

Very careful records are kept of the details of operation; charging the furnace, melting, refining, casting, rolling, examination and dressing of the finished steel. These data are continually being examined, and this examination is facilitated by making use of the comptometer department. This enables a much greater mass of data to be analysed than would be otherwise possible.

The author then proceeded to give some examples, as follow:—

It was most important that the quality of the billet produced in the Templeborough mill should be improved. There was much uncertainty as to how far the steel itself was at fault or how far the heating and rolling was to blame for the poor results. Systematic observation and correlation of furnace and casting pit data with the yield data began to produce good results. The practice of bottom pouring was rapidly extended, as bottom-poured ingots, cone shaped at both ends, were found to give a 3 per cent. to 4 per cent. better yield than top-poured ingots; a much superior surface finish with correspondingly less dressing. It was found that the percentage of cracked ingots could be more easily reduced, by controlling the teaming speed by a partially shut stopper, than simply by nozzle size and grouping. Controlling the teeming speed by stopper control was found to necessitate a number of alterations in practice. The nozzle was lengthened from 7 in. to 10¼ in.; the practice was adopted of always boiling the nozzles in tar until they were saturated throughout. This was found to eliminate the danger of split nozzles, reduce the wear, and also put an end to the danger of stopper and nozzle sticking together when they got hot and plastic. It was also found necessary to enlarge the stopper end.

(To be continued.)

The Week's News in Brief

Trade Talk

THE MANUFACTURE and export of aluminium kitchen ware has been prohibited by the Board of Trade.

E. JOHN WHEEN & COMPANY, LIMITED, engineers' and iron and steel agents, have removed from 121, Cannon Street, London, E.C.4, to 30, Walbrook, E.C.4.

THE Stainless Steel Manufacturers' Export Group has been formed, with Mr. E. J. Gadsby, Wharncliffe House, 44, Bank Street, Sheffield, 1, as secretary.

KEIGHLEY ASSOCIATION OF ENGINEERS was addressed last week by Dr. C. J. Dadswell on the subject of "Mass-Production Methods Applied to the Steel Foundry."

COX & DANKS, LIMITED, iron and steel scrap merchants, have transferred their registered office and accounts department from Park Royal, London, to The Grove, Rainbow Hill, Worcester.

A SUPPLY of coke-oven gas provided by Workington Town Council and supplied by the Workington Iron & Steel Company has been inaugurated for the Ennerdale rural area of Cumberland.

MISS K. V. ALLEN has replaced Mr. K. W. Bridges as secretary of the Foundry Equipment Export Group and the Furnace Export Group. The address of these groups is now Millwood, King Acre Road, Hereford.

MR. ERNEST BEVIN, Minister of Labour, hopes to publish shortly an Order that all uncovered glass in factories on urgent work, or where people have to continue working during raids, is to be either removed or covered with expanded metal to prevent splinters.

AN OFFICIAL NOTE relating to the Purchase Tax states that the following articles of interest to the foundry industry are not chargeable:—Fretwork tools, sold separately; coin- or disc-operated machines solely for the delivery of goods, *e.g.*, chocolate machines.

THE REPORT of the International Nickel Company of Canada, Limited, and subsidiaries for the nine months ended September shows a net profit in U.S. currency of $26,425,104 after all charges, depreciation, taxes, etc., equivalent after preferred dividend to $1.71 a share on the 14,584,025 no par Common shares.

THE IRON AND STEEL CONTROL has inaugurated a new voluntary scheme to encourage the private owner to give up his railings for the scrap metal campaign. A start is being made in the Midlands area—Leicestershire, Shropshire, Staffordshire, Warwickshire and Worcestershire—with Birmingham as the centre, and the scheme will be extended to other districts as soon as results from the Midlands area are received.

THE TREASURY have issued the Import Duties (Exemptions) (No. 9) Order, 1940, which exempts from duty tubes and pipes of iron or steel, other than cast tubes and pipes, and steel bulbs of the kind used in aerated water syphons, and the Additional Import Duties (No. 10) Order, 1940, which removes the additional duties on certain forgings of iron or steel. The Orders came into operation on November 14 and are published by H.M. Stationery Office as S.R. & O., 1940, Nos. 1960 and 1961.

IN 1939, the production of the South African Iron and Steel Industrial Corporation, Limited, included the following: Coke, including coke breeze, 222,557 tons; crude tar, 2,392,845 galls.; road tar, 1,869,094 galls.; pig-iron, all grades, 26,822 tons, and for further processing, 287,899 tons, a total of 314,721 tons; steel ingots for further processing, 349,155 tons. The heavy mills produced the following: Blooms, 1,809 tons; sections, 37,097 tons; rails, 58,954 tons; light mill billets, 45,131 tons; other billets, 60,513 tons, and sheet bar, 80,334 tons. The light mills produced 2,781 tons of angles, 1,941 tons of fencing standards, 1,343 tons of flats, and 34,345 tons of rounds. The sheet works made 42,081 tons of sheets and 23,674 tons of plates.

As the result of recent investigations into salvage problems on the Great Western Railway, measures have been taken to ensure the maximum recovery of all scrap materials so as to make them available for the nation's war effort. The procedure for the recovery of scrap by the large engineering departments was already well defined, but special steps have been taken to make sure that no single item capable of further use is overlooked. The discovery and collection of the numerous odd bits of waste materials which accumulate on the company's premises in all parts of its system, however, needed altogether different treatment. As an essential corollary to the success of the scheme which has been formulated, the active co-operation of the whole of the staff of approximately one hundred thousand has been enlisted. To clear the accumulation of scrap a number of special salvage wagons are being provided to make regular calls at all the principal stations.

Personal

MR. W. PLANT, B.Sc., has been appointed works manager to Clegg & Murray, Limited, malleable ironfounders, of Bingley, Yorks.

MR. J. W. GARDOM has changed his address to The Vicarage, Wessington, Derbyshire. His telephone number is Alfreton 201.

SIR CHARLES CRAVEN is returning to the Vickers-Armstrongs group of companies. All the works in the group have been informed that at the particular request of the chairman of Vickers, Limited, the Government have released Sir Charles from his duties at the Ministry of Aircraft Production, where he has been engaged for the last six months, in order that he may resume his chairmanship and managing directorships of these companies.

Will

SPENCER, C. F., chairman of the Leeds Fireclay Company, Limited, Coal Conversion, Limited, and the Edison Swan Electric Company, Limited, a director of Thos. Firth & John Brown, Limited £92,488

Obituary

MR. G. H. TOMLINSON, who has died at the age of 80, for thirty years conducted a foundry business in Burnley.

SIR CHARLES LANGBRIDGE MORGAN, past president of the Institution of Civil Engineers, died at Hove on November 9, aged 85. He was formerly chief engineer of the London, Brighton & South Coast Railway and a director of the Southern Railway.

MR. THOMAS HADDEN, a noted wrought-iron craftsman, has died in Edinburgh. Mr. Hadden set up a forge in Edinburgh 40 years ago. His expert craftsmanship is to be seen in the wrought-iron screen at the entrance to the Shrine at the Scottish National War Memorial. He was 67 years of age.

THE DEATH has occurred of Mr. D. Timmins, managing director of D. Timmins & Sons, Limited, engineers and ironfounders, of Fishponds, Bristol. He was aged 64. Mr. Timmins received his training under Mr. Robert Buchanan, the first President of the Institute of British Foundrymen, at W. & T. Avery, Limited, Birmingham. Later he was foreman for Parnall & Sons, Limited, Fishponds, Bristol. After some years with this firm he started up business on his own account, trading as the City Foundry, Bristol. When he disposed of this foundry in 1919, he became foundry manager with P. & A. Campbell, Limited, Bristol, resigning two years ago to form his own company.

Sugar-Mill Rolls

According to a Paper presented to the Newcomen Society by Mr. Noel Deerr and Mr. Alexander Brooks, the modern sugar mill was invented in 1449 by Pietro Speciale, Prefect of Sicily. The first maker of iron shells to cover the wooden cores of the rolls was almost certainly George Sitwell, of Renishaw, in 1652. Sitwell was then operating furnaces and forges near Derby.

New Companies

(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.)

Hard Alloys, Limited—Capital, £5,000. Metal workers, etc. Subscriber: C. Rubens, 73, Basinghall Street, London, E.C.2.

Salopian Engineers, Limited, Shrewsbury Road, Prees, Whitchurch, Salop—Capital, £20,000. To take over the business of agricultural engineers, etc. Directors: H. W. Batkin and H. S. Morris.

Curran Industries, Limited, Hurman Street, Bute Docks, Cardiff—Capital, £10,000. Hardware manufacturers and merchants, constructional and mechanical engineers, etc. Directors: J. and P. E. Curran.

D. Naylor Altsac, Limited—Capital, £2,000. Tool, pattern and machinery designers, engineers, etc. Directors: R. Gibson, 32, Albert Road, Allesley, Coventry; C. Castledine, J. A. Roberts, and A. H. Pattison.

Applications for Trade Marks

The following list of applications to register trade marks has been taken from the "Trade Marks Journal":—

"FAG"—Anti-friction bearings, etc. FISCHER BEARINGS COMPANY, LIMITED, Upper Villiers Street, Wolverhampton.

Application to the Cutlers' Company, Sheffield.

"CUTTER" (yacht device)—Steel, and various machine tools. SAMUEL OSBORN & COMPANY, LIMITED, Clyde Steelworks, Wicker, Sheffield.

Reports and Dividends

Revo Electric Company, Limited—Interim dividend of 5 per cent.

Tweedales & Smalley (1920), Limited—Interim dividend of 2½ per cent.

Atlas Steel Foundry & Engineering Company, Limited—Final dividend of 17½ per cent. and a bonus of 10 per cent., making 42½ per cent.

Crabtree Electric Industries, Limited—Profit for the year ended October 31, £75,119; brought in, £19,090; preference dividend, £10,500; final dividend on the ordinary shares of 5 per cent. and a cash bonus of 7½ per cent., making 17½ per cent.; carried forward, £19,665.

Lightalloys, Limited—Net profit for the 53 weeks to June 30, after providing for taxation, £35,827; brought in, £5,349; A.R.P. expenditure, £1,000; to contingencies reserve, £4,000; final dividend of 12½ per cent., making 25 per cent. for the year; carried forward, £5,176.

Wombwell Foundry & Engineering Company, Limited—Profit for the year ended July 31, £13,188; to depreciation reserve, £2,500; taxation, £4,728; to general reserve, £500; to taxation reserve, £1,500; brought in, £5,137; dividend of 10 per cent., £3,737; carried forward, £5,359.

Samuel Osborn & Company, Limited—Profit for the year ended July 31, after making provision for pensions and contingencies, depreciation, bad and doubtful debts, income tax, N.D.C., and E.P.T., £73,193; brought in, £83,628; preference dividend for the year, £7,183; interim dividend of 2½ per cent. on the ordinary shares, £4,578; final dividend of 12½ per cent. on the ordinary shares, making 15 per cent., £21,106; carried forward, £123,953.

Stothert & Pitt, Limited—Profit for the year ended June 30, after providing for war risk insurance and other special war expenses, £133,958; E.P.T., £42,500; income tax, £33,490; to income tax reserve, £28,500; brought in, £21,926; balance of taxation on profits of previous year, £7,070; dividend on the preference shares, £2,393; dividend on the ordinary shares of 10 per cent., £14,375; bonus of 2½ per cent. on the ordinary shares, £3,594; carried forward, £23,962.

Forthcoming Event

Institute of British Foundrymen

NOVEMBER 30.

Falkirk Section:—"This and That," Paper by T. Tyrie, at Falkirk, at 6 p.m.

Acknowledgments to Manganese Bronze and Brass Co. Ltd., Woodall-Duckham Co. (1920) Ltd., and Hadfields Ltd.

The modern development of refractory materials owes much to close co-operation between manufacturer and user of refractories. As Britain's leading manufacturers, General Refractories enjoy the custom and confidence of many thousands of refractories users engaged in every branch of the metallurgical, engineering and other industries of the world. This intimate relationship is fostered by General Refractories because it provides "G.R." engineers and chemists with a real close-up picture of the actual needs of every type of user. In addition, it provides an invaluable fund of practical experience—which proves the soundest basis on which to maintain and develop a high standard of consistently uniform quality products. This method of procedure is your assurance that there is not only a "G.R." product made for your particular business—but that if you have a problem involving refractories, "G.R." data and experience will help you to find the answer. We want you to feel free to consult the "G.R." Technical Advisory Section at all times. It will enable you to tap this vast organisation for the greater efficiency of your business or plant.

GENERAL REFRACTORIES LTD.

HEAD OFFICE: GENEFAX HOUSE, SHEFFIELD, 10. TELEPHONE 31113 (6 LINES)

G.P.5.

FIREBRICKS: *Glenboig Special, Glenboig Special Crown, Glenboig, Glenboig Crown, Castlecary, Dykehead, Gem, White Carr, Stour, Hycone, Alumantine, Hysilyn, Adamantine, Llangennech.*
BASIC BRICKS: *Spinella, Saxpyre, Supermag, Diazite, Dolomax.*
ACID-PROOF REFRACTORIES: *Obsidianite, Losol.*

INSULATION: *Amberlite* Bricks, Cement and Concrete.
SILICA BRICKS: *Lowood, Meltham, Allen, Quartex.*
CEMENTS: *Sintex, Durax, Pyrolyte.* PLASTICS: *Durax, Rotaline, Plastic K-N., Glendoline, Ground Ganister.*
SILLIMANITE: Tank Blocks, Bricks and Cements,
SANDS: Moulding, Brick Facing, Silica, Glass.

Raw Material Markets

Pressure for supplies of iron and steel is unabated, despite the recent advance in selling prices. Most of the orders are for material required for Government contracts, prices being of secondary consideration, as delivery is the primary factor. There appears to be little, if any, relaxation in the ordinary domestic demand, but the extensive war needs permit only a very moderate volume of this business. A feature of the foundry industry of late has been the improvement among makers of light castings, many of whom have been entrusted with additional work of national importance. In the main, however, these foundries have not yet been able to operate their plants to full capacity, and short time exists in the trade.

Pig-Iron

MIDDLESBROUGH—Railway deliveries of foundry iron from Derbyshire and Northamptonshire furnaces to this district have been maintained, and the supply position is quite satisfactory. The contribution of the Cleveland makers is still negligible, the demand for steelmaking irons precluding the transference of furnaces engaged on these irons to the production of foundry numbers. Very few consumers are in any way inconvenienced and outputs are not hampered at all. Licences are being fulfilled for deliveries up to the end of the year, and buyers are now paying the recently increased prices on all supplies, as their contracts with producers included a rise-and-fall clause. That there is now rather an easier tone with regard to hematite is largely due to the distribution of iron imported from the United States, substantial ship loads having recently arrived, with the prospect of good cargoes becoming available for some time ahead. Local works are accounting for a large proportion of the production of East Coast hematite, so that the tonnage left is not sufficient to meet the demand.

LANCASHIRE—Light-castings and jobbing foundries continue to be the quietest users of foundry iron in this area, both having difficulty in finding enough work to keep their plant in continuous operation. In the aggregate, however, the call for iron is on a heavy scale, speciality and general engineers being to the fore in this respect. Most of these concerns are fully employed on orders placed by Government departments, and there is likely to be a steady flow of similar specifications for the duration of hostilities. Midlands iron is consumed by Lancashire users in the main, and it is satisfactory to report that adequate deliveries are being made, although there is no iron to spare. Essential requirements of West Coast hematite are being met, but a certain tightness exists still, and strict control is exercised over distribution.

MIDLANDS—Ironmakers are being called upon to deal with heavy orders, but outputs are at a very high level, and the supply position, on the whole, may be described as satisfactory. Notwithstanding a heavier demand for high-phosphorus iron for the light-castings trade, deliveries are being made freely at present, but producers' stocks are on the small side. Not since the outbreak of the war has the situation among makers of light castings been so favourable as it is to-day; nevertheless, more work is required before these foundries can be fully employed. The recent improvement has been due largely to the receipt of additional Government contracts and also to wider specifications for the building trade. It is, of course, hoped that still more orders will emanate from various Government departments, as light-castings foundries have been somewhat neglected in this respect in the past owing to many of them being unable to adapt their plant to the production of the required type of goods. Distribution of both low-phosphorus iron and hematite has been very much better recently, but resource has had to be made to the importations arranged by the Control authorities. These grades of iron are used chiefly by makers of heavy castings and machine tools and machinery manufacturers, all of whom have been working to capacity for months past. Refined iron, too, is used to a considerable extent by these concerns, and deliveries have been quite gratifying, while the supply of cast-iron and steel scrap is now substantial.

SCOTLAND—Current requirements of foundry iron are being met satisfactorily, but there has so far been little provision for buyers to accumulate reserve stocks, which they naturally desire to do. Heavy engineering establishments have all the work on hand which they can accept, but light-castings makers continue to seek new business, although they are certainly much better placed than they were a short time ago. The volume of Government work which has been made available to these foundries has been disappointing, but a little more now seems to be coming through.

Coke

Business in the foundry-coke market has not been affected by the introduction of higher prices so far as can be ascertained. The larger consumers had already entered into contracts to secure their requirements ahead and now have to pay the higher quotations, but it is noticeable that they continue to purchase their current needs in order to leave their stocks intact. For delivery to Birmingham and Black Country stations, Durham best foundry coke is now quoted at 58s. per ton; no date has been fixed for further consideration of prices, which are subject to official control. Producers are able to make large deliveries, as much of the coke which in normal times would have been shipped is now at the disposal of home consumers.

Steel

Most steelmakers have an exceptionally large number of orders on hand and pressure for supplies is maintained in all directions. Works are committed for several months to come on priority contracts, so that the negotiation of fresh business is difficult. All inquiries have first, of course, to be sanctioned by the Control and very few orders are being licensed which do not come within the priority category. The insistent demand for steel affects all descriptions and it is only with the assistance of foreign material that the pressure can be relieved.

Scrap

Accumulations of scrap supplies have now attained extensive levels and in most directions there is more than enough metal available to meet all inquiries. Consumers are taking the opportunity to build up stocks, while merchants, too, have big tonnages awaiting disposal. Many users are already benefiting from their prudent accumulation of supplies, as in certain parts deliveries have been held up temporarily owing to congestion of transport. No official intimation has been forthcoming, but the possibility of higher prices being charged for iron and steel scrap in the near future is not being lost sight of.

Metals

While the amount of copper available for export does not appear to be very great, the needs of essential users of the red metal are being met in full and without delay. In the United States, a quieter tone has developed in the domestic market following the heavy buying of a few weeks ago, most of the larger consumers now having heavy tonnages on hand or on order. In addition to U.S. production, there are large supplies available to users from other parts of the American Continent, which prevent the supply situation from becoming really tight.

It is reported from Washington that at conferences held between copper producers and consumers for national defence purposes, it was decided that the United States needs more copper than she can herself produce next year. A number of vital steps have been, or will be, taken, including a decision to supplement United States production by importations from American-owned Latin American mines; and by the insertion of a protective clause in contracts of copper from Chile to Japan providing for their cancellation in the event of the metal being needed by either Chile or the United States.

Business in tin on the London Metal Exchange has been on moderately active lines, but prices have pursued a steady course and there seems to be no reason to anticipate any material change for some time to come. There has been no outstanding development on the American tin market since Mr. Roosevelt's successful campaign, but it is, perhaps, too early to pass comment on the future of tin purchasing as a result of the President's adoption for a further period. Stocks in the United States seem to be at a fairly high level, although substantial withdrawals may be made soon, when the tinplate industry resumes on a more active scale, while consumption in connection with the defence programme generally should involve the utilisation of large tonnages.

The U.S. National Defence Advisory Commission has appointed a Technological Committee on tin smelting. The Committee will review several proposals placed before the Metals Reserve Company relating to the establishment of a tin smelter in America and the recommendation of one of the proposals is expected.

London Metal Exchange tin prices this week have been as follow:—

Cash—Thursday, £259 to £259 10s.; Friday, £259 to £259 10s.; Monday, £257 15s. to £258 5s.; Tuesday, £257 10s. to £257 15s.; Wednesday, £257 15s. to £258 5s.

Three Months—Thursday, £260 15s. to £261; Friday, £260 10s. to £260 15s.; Monday, £259 15s. to £260; Tuesday, £259 10s. to £259 15s.; Wednesday, £259 15s. to £260.

The United Kingdom spelter position shows little change from week to week. Essential users are acquiring all they need to ensure continuous production, but deliveries to other destinations are restricted. Metal is arriving from overseas satisfactorily, and, despite intensification of the U-boat campaign against Allied shipping, there is no reason to suppose that the supply of zinc will be seriously disturbed. Stocks in the United States are on the low side, especially when the potential needs of the defence programme are considered. Smelting capacity in America may be adequate in normal times, but the industry is being strained by the vastly enlarged demands now being made upon it. The situation is not being passed by unnoticed, however, and steps now being taken should improve the position at an early date.

Supplies of lead are plentiful, but the demand apart from works engaged on Government contracts is not heavy. The American market remains firm.

U.S.S.R. Steel Industry

It has been announced from Moscow that the U.S.S.R. is projecting the establishment of three new iron and steel plants during the next five years, which it is claimed will make Russia the principal steel producer in Europe and Asia. It is understood that one plant will be located in the southern Urals, one in the north-west of Russia in Europe and the other in Siberia. The whole of the plant for equipping these works is to be made in Russia. It may be recalled that in the course of the first five-year plan three plants were built by American engineers, one at Magnitogorsk, one at Kusnetsk, and the third in southern Russia near the Sea of Azov.

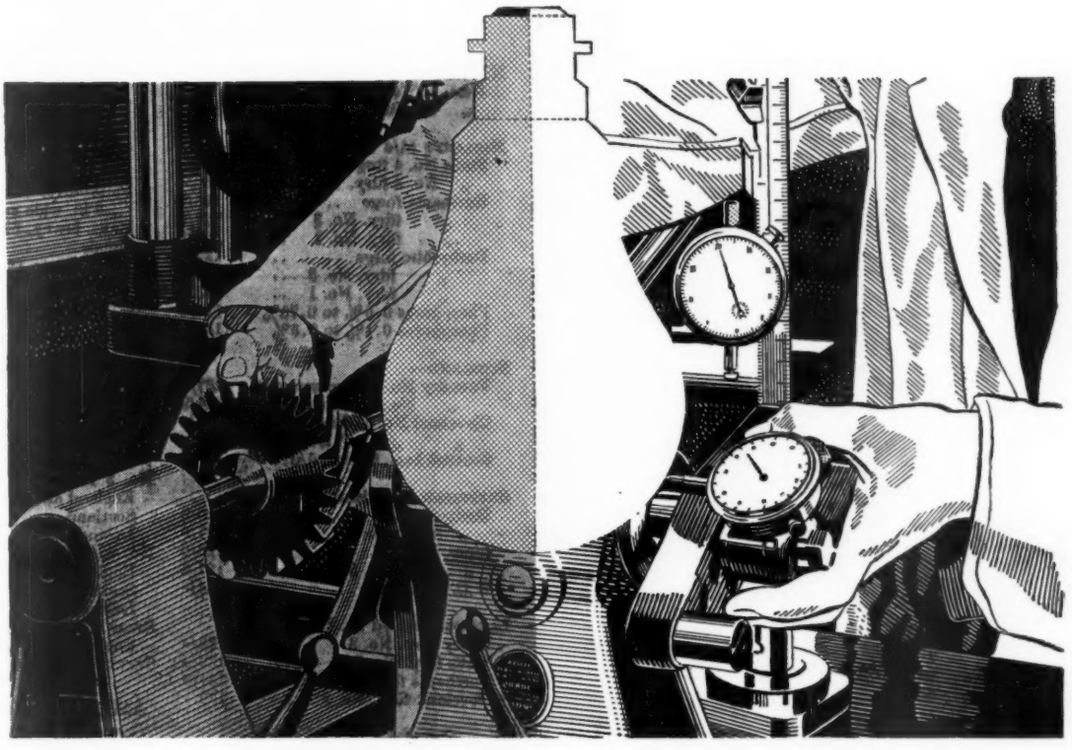
Casting Defects Common to Motor-Vehicle Grey Iron

(*Continued from page* 338.)

If it shows signs of "cuts" or "washes," then the binder or baking time and temperature are at fault. *Remedy*—use a binder that will not break down as readily and bake the core at as near the optimum baking time and temperature as possible.

If the cored surface of the casting shows a "burnt-in" or "sandy appearance," the remedy is the same as that for *h* under conditions of moulding sand and mould, if the cores are not coated.

Light up—for accuracy!



A big scrap-heap is a testimonial in peace-time. In war it is a sign of waste—of labour, of wages, and of that vital element, *time*. Look to the lighting of every process, every shop, every inspection table. Spot the faults in material quicker, before the work is put in on it. Fit Osram and get the light you pay for, reliable, brilliant, time-saving. Accurate finish is winning this war—don't let it cost too much to achieve by poor lighting.

Osram

A G.E.C. PRODUCT

THE WONDERFUL LAMP

Advt. of The General Electric Co. Ltd., Magnet House, Kingsway, London, W.C.2

RAW MATERIALS—PRICE LIST

Wednesday, November 20, 1940

COPPER*

	£	s.	d.
Electrolytic	62	0	0
High-grade fire-refined	61	10	0
Fire-refined of not less than 99.7 per cent.	61	0	0
Do., do., 99.2 per cent.	60	10	0
Black hot-rolled wire rods	65	10	0

TIN

	£	s.	d.
Standard cash	257	15	0
Three months	259	15	0
Settlement	258	0	0
Official average Cash, Oct.	258	3	0 1/23
Do. Three Months, Oct.	260	10	3 2/23
Do. Settlement, Oct.	258	2	9 21/23

SPELTER*

	£	s.	d.
G.O.B. (foreign) (duty paid)	25	15	0
Do. (domestic)	26	10	0
"Prime Western"	26	10	0
Refined and electrolytic	27	5	0
Not less than 99.99 per cent.	28	15	0

LEAD*

	£	s.	d.
Good soft pig lead (foreign) (duty paid)	25	0	0
Do., do., (Empire and domestic)	25	0	0
English	26	10	0
Sheets, home	34	10	0
Do. export, f.o.b.	30	0	0
Pipes, home	34	0	0
Do. export, f.o.b.	30	10	0
Tea lead (nom.)	—		

ALUMINIUM

Ingots	£110
Wire, 10g.	nom.
Sheets	nom.
Circles, 20/24g.	nom.

ZINC SHEETS, etc.

	£	s.	d.
Sheets, 10g. and thicker, ex works	39	2	6
Rolled zinc (boiler plates), ex works	37	2	6
Zinc oxide (Red Seal), d/d buyers' premises	28	7	6

ANTIMONY

English, 90%, delivered	90 0 0
Foreign Regulus, duty paid	90 0 0 to 93 0 0
Chinese, prompt shipment, c.i.f.	78 0 0 to 82 0 0

QUICKSILVER

Quicksilver, ex-w'hse London 50 0 0 to 54 10 0

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	3s. 0d.
Finished bars, 18% tungsten	3s. 10d.
Finished bars, 22% tungsten	4s. 4d.

Per lb. d/d buyers' works.

NICKEL SILVER, etc.

	Per lb.
Ingots for raising	9d. to 1/3
Rolled—	
To 9 in. wide	1/3 to 1/9
To 12 in. wide	1/3½ to 1/9½
To 15 in. wide	1/3½ to 1/9½
To 18 in. wide	1/4 to 1/10
To 21 in. wide	1/4½ to 1/10½
To 25 in. wide	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5½
Ingots rolled to spoon size	1/- to 1/8½
Wire round—	
to 10g.	1/6½ to 2/1½

with extras according to gauge.

Special 5ths quality turning rods in straight lengths, 1/5½ upwards.

* Maximum prices per long ton delivered to buyers' premises.

FERRO-ALLOYS AND STEEL-MAKING METALS

(all prices nominal.)

	£	s.	d.
Ferro-silicon (5-ton lots)—			
25%	18	10	0
45%	23	10	0
75%	36	10	0
Ferro-vanadium—			
35/50%	15/6 lb. Va.		
Ferro-molybdenum—			
70/75% carbon-free	6/- lb. Mo.		
Ferro-titanium—			
20/25% carbon-free	1/9 lb.		
Ferro-tungsten—			
80/85%	5/1 lb.		
Tungsten metal powder—			
98/99%	5/2½ lb.		
Ferro-chrome—			
2/4% car.	—		
4/6% car.	47	0	0
6/8% car.	47	0	0
8/10% car.	—		
Ferro-chrome—			
Max. 2% car.	—		
Max. 1% car.	—		
Max. 0.5% car.	—		
70% carbon-free	—		
Nickel—99.5/100%	£190 to £195		
"F" nickel shot	175	0	0
Ferro-cobalt, 98/99%	8/9 lb.		
Metallic chromium—			
96/98%	3/9 lb.		
Ferro-manganese—			
76/80% loose	18	10	0
76/80% packed	20	0	0
Metallic manganese—			
94/96% carbon-free	1/9 lb.		

Per ton unless otherwise stated, basis 2-ton lots, d/d Sheffield works.

SCRAP*

	£	s.	d.	£	s.	d.
SOUTH WALES—						
Short heavy steel, not ex. 24-in. lengths	3	16	6	to 3	19	0
Heavy machinery cast iron				4	6	6
Ordinary heavy cast iron				4	1	6
Cast-iron railway chairs				4	6	6
Medium cast iron				3	17	9
Light cast iron				3	13	0
MIDDLESBROUGH—						
Short heavy steel	3	14	3	to 3	16	9
Heavy machinery cast iron				4	11	3
Ordinary heavy cast iron				4	8	9
Cast-iron railway chairs				4	8	9
Medium cast iron				3	19	0
Light cast iron				3	14	0
BIRMINGHAM DISTRICT—						
Short heavy steel	3	9	3	to 3	11	9
Hematite ingot mould				5	10	9
Heavy machinery cast iron				4	11	9
Ordinary heavy cast iron				4	7	0
Cast-iron railway chairs				4	7	0
Medium cast iron				3	19	9
Light cast iron				3	14	9
SCOTLAND—						
Short heavy steel	3	14	0	to 3	16	6
Heavy machinery cast iron				4	13	9
Ordinary heavy cast iron				4	8	9
Cast-iron railway chairs				4	13	9
Medium cast iron				3	16	9
Light cast iron				3	11	9

* Delivered free to consumers' works in England and Wales. For deliveries of cast-iron scrap free to consumers' works in Scotland, the above prices less 3s. per ton, but plus actual cost of transport or 6s. per ton, whichever is the less. All prices: Plus 2½ per cent. dealers' remuneration: 50 tons and upwards over three months 2s. 6d. extra.

PIG-IRON*

	£	s.	d.
N.E. COAST (d/d Tees-side area)—			
Foundry No. 1	131/-		
„ No. 3	128/-		
„ No. 4	127/-		
Forge No. 4	127/-		
Hematite No. 1	138/6		
Hematite M/Nos.	138/-		
N.W. COAST—			
Hem. M/Nos. d/d Glasgow	138/6		
„ d/d Birmingham	150/-		
MIDLANDS (d/d Birmingham dist.)—			
Staffs No. 4 forge	129/-		
„ No. 3 fdry.	130/-		
Northants forge	126/6		
„ fdry. No. 3	127/6		
„ fdry. No. 1	130/6		
Derbyshire forge	129/-		
„ fdry. No. 3	130/-		
„ fdry. No. 1	133/-		
Phosphorus 0.5% to 0.75%	137/6		
Phosphorus 0.1% to 0.5%	140/6		
SCOTLAND—			
Foundry No. 1, Grangemouth	127/3		
„ No. 3, Grangemouth	124/9		
Cleveland No. 3, Glasgow	131/-		
„ „ Falkirk	128/-		
Scottish hem. M/Nos. d/d	138/6		
SHEFFIELD (d/d district)—			
Derby forge	126/6		
„ fdry. No. 3	127/6		
Lincs forge	126/6		
„ fdry. No. 3	127/6		
W.C. hematite	144/-		
LANCASHIRE (d/d eq. Man.)—			
Derby fdry. No. 3	133/-		
Staffs fdry. No. 3	133/-		
Northants fdry. No. 3	131/6		
Cleveland fdry. No. 3	133/-		
Cylinder and Refined Irons			
North Zone	174/-		
South Zone	176/6		
Refined Malleable			
Birmingham and S. Staffs	171/6		
Cold Blast			
South Staffs	220/6		

* Prices of hematite and basic pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton under certain conditions.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.

	£	s.	d.
BASIC:			
Soft, u.t., 100-ton lots	12	5	0
Tested, up to 0.25% C.	12	10	0
Tested, 0.25 to 0.33% C.	12	12	6
Tested, 0.33 to 0.41% C.	12	15	0
Hard (0.42 to 0.60% C.)	13	17	6
„ (0.61 to 0.85% C.)	14	7	6
„ (0.86 to 0.99% C.)	14	17	6
„ (1% C. and up)	15	7	6
Silico-manganese	16	5	0
Free-cutting	14	10	0
SIEMENS MARTIN ACID			
Up to 0.25% C.	15	15	0
Case-hardening	16	12	6
Silico-manganese	16	5	0

Billets, Blooms and Slabs for Forging and Stamping.

Basic soft, up to 0.25% C.	13	17	6
Basic hard, 0.41 to 0.60% C.	14	10	0
Acid, up to 0.25% C.	16	5	0

Other Semi-products, etc.

Tin bars	12	2	6
Sheet bars	12	2	6
*Wire rods, soft basic	17	7	6
„ hard basic	21	2	6
„ free-cutting	20	2	6
„ acid	24	13	

* Subject to rebate.

FINISHED STEEL

Usual district deliveries.

[A rebate of 15/- per ton for steel bars, sections, plates, joists and hoops is obtainable in the home trade under certain conditions.]

	£	s.	d.
Plates, ship (N.E. Coast)	16	3	0
Boiler plts. (N.E. Coast)	17	0	6
Chequer plts. (N.E. Coast)	17	13	0
Angles, over 4 un. ins.	15	8	0
Tees, over 4 un. ins.	16	8	0
Joists, 3 in. × 3 in. and up	15	8	0
Rounds and squares, 3 in. to 5½ in.	16	8	0
Rounds under 3 in. to ⅜ in. (untested)	17	12	0
Flats—over 5 in. wide	15	13	0
„ 5 in. wide and under	17	12	0
Rails, heavy, f.o.t.	14	10	6
Hoops	18	7	0
Black sheets, 24 g. (4 t. lots)	22	15	0
Galv. cor. shts. („)	26	2	6
Galv. flat shts. („)	26	12	6
Galv. fencing wire, 8g. plain	26	17	6

FINISHED IRON

	£	s.	d.
CROWN IRON:			
England and Wales	15	12	6
Scotland	15	12	6
Ireland, f.o.q.	16	5	0
No. 3 BARS:			
England and Wales	12	10	0
Scotland	13	12	6
Ireland, f.o.q.	13	2	6
No. 4 BARS:			
England and Wales	13	0	0
Scotland	13	17	6
Ireland, f.o.q.	13	12	6
STRIP:			
England and Wales	17	0	0
STAFFS MARKED BARS, f.o.t.	—		

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated, October 22, 1940.

	Dols.
No. 2 foundry, Phila.	24.84
No. 2 foundry, Valley	23.00
No. 2 foundry, Birm.	19.38
Basic, Valley	22.50
Malleable, Valley	23.00
Grey forge, Valley	22.50
Ferro-mang., seaboard	120.00
O.-h. rails, h'y, at mill	40.00
Billets	34.00
Sheet bars	34.00
	Cents
Iron bars, Chicago	2.25
Steel bars	2.15
Tank plates	2.10
Beams, etc.	2.10
Wire rods	2.00
Skelp, grooved steel	1.90
Steel strip	2.10
Steel sheets	2.10
Sheets, galv., 24 g.	3.50
Wire nails	2.55
Plain wire	2.60
Tinplates, 100-lb. box	$5.00

COKE (at ovens)

Welsh foundry	45/- to 46/6
„ furnace	34/- to 35/6
Durham foundry	42/-
„ furnace	35/11
Scottish foundry	45/- to 50/-
„ furnace	33/6 to 35/6

TINPLATES

f.o.b Bristol Channel ports

I.C. cokes	20 × 14 per box	30/9 to 32/-
„	28 × 20 „	61/6 to 64/-
„	20 × 10 „	44/3 to 44/9
„	18¾ × 14 „	32/- to 32/6
C.W.	20 × 14 „	27/9 to 28/9
„	28 × 20 „	55/6 to 57/6
„	20 × 10 „	42/3 to 42/9
„	18¾ × 14 „	30/- to 30/6

NON-FERROUS SCRAP

(Official Maximum Prices, per ton ex Works.)

	£	s.	d.
Bright untinned copper wire, in crucible form or in hanks	57	10	0
No. 1 copper wire	57	0	0
No. 2 copper wire	55	10	0
Copper firebox plates, cut up	57	10	0
Clear untinned copper, cut up	56	10	0
Braziery copper	53	10	0
Q.F. process and shell-case brass, 70/30 quality, free from primers	49	0	0
Clean fired 303 S.A. cartridge cases	47	0	0
70/30 turnings, clean and baled	43	0	0
Brass swarf, clean, free from iron and commercially dry	34	10	0
New brass rod ends, 60/40 quality	38	10	0
Hot stampings and fuse metal, 60/40 quality	38	10	0
Admiralty gunmetal, 88-10-2, containing not more than ½ per cent. lead or 3 per cent. zinc, or less than 9½ per cent. tin	72	0	0

NEW BRASS TUBES, etc.

	Per lb.
Solid drawn tubes	13½d.
Brazed tubes	15½d.
Rods, drawn	11½d.
Rods, extd. or rlld.	8½d.
Sheets to 10 w.g.	10½d.
Wire	10½d.
Rolled metal	9½d.
Yellow metal rods	8½d.

COPPER TUBES, etc.

Solid drawn tubes	14½d.
Brazed tubes	14½d.
Wire	9½d.

PHOSPHOR BRONZE

	Per lb. basis
Strip	13½d.
Sheet to 10 w.g.	13½d.
Wire	15½d.
Rods	15½d.
Tubes	20½d.
Castings	17d.

Delivery 3 cwt. free.
10% phos. cop. £35 above B.S.
15% phos. cop. £40 above B.S.
Phosphor tin (5%) £40 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

A COMPARISON OF SCRAP PRICES

Average Delivered Prices of Heavy Steel Scrap (large quantities) in the Principal Districts at the Beginning of Each Month in the Years 1933–1940.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Scotland—													
1933	1 15 0	1 17 6	1 18 6	1 18 9	1 18 0	1 17 6	1 18 9	2 0 0	2 2 6	2 5 0	2 7 6	1 15 0	1 16 9½
1934	2 8 9	2 14 3	2 13 0	2 13 0	2 12 0	2 10 0	2 10 6	2 10 6	2 11 0	2 10 9	2 10 0	2 8 9	2 0 7½
1935	2 10 0	2 10 0	2 10 0	2 10 0	2 10 0	2 10 0	2 10 0	2 10 0	2 10 0	2 10 0	2 10 0	2 10 0	2 11 2
1936	2 12 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 1
1937	2 17 6	3 2 6	3 6 0	3 5 9	3 5 9	3 5 9	3 5 9	3 5 9	3 5 9	3 6 3	3 6 3	3 6 3	3 4 9½
1938	3 6 3	3 6 3	3 6 3	3 6 3	3 6 3	3 6 3	3 6 3	3 6 3	3 6 3	3 6 3	3 6 3	3 6 3	3 6 3
1939	2 17 9	2 17 9	2 17 9	2 17 9	2 17 9	2 17 9	2 17 9	2 17 9	2 17 9	2 19 0	2 19 0	2 19 0	2 18 0½
1940	2 19 0	2 19 0	3 9 0	3 9 0	3 9 0	3 9 9	3 9 9	3 9 9	3 9 9	3 9 9	—	—	—
North-East Coast—													
1933	2 0 0	2 0 0	2 5 0	2 0 0	1 15 0	1 17 6	2 2 6	2 2 6	2 3 6	2 5 0	2 7 6	2 7 6	2 2 2
1934	2 10 0	2 16 0	2 10 0	2 7 6	2 7 6	2 10 0	2 9 9	2 10 0	2 10 0	2 10 0	2 11 6	2 11 3	2 10 3½
1935	2 11 6	2 11 9	2 12 0	2 12 0	2 12 6	2 12 6	2 12 6	2 12 6	2 12 6	2 12 6	2 12 6	2 13 9	2 12 4½
1936	2 15 0	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	2 17 6	3 0 0	3 0 0	2 17 8½
1937	3 2 6	3 5 0	3 7 0	3 7 9	3 7 9	3 7 9	3 7 9	3 7 9	3 7 9	3 7 9	3 8 3	3 8 3	3 7 1½
1938	3 8 3	3 8 3	3 8 3	3 8 3	3 8 3	3 8 3	3 8 3	3 8 3	3 8 3	3 8 3	3 8 3	3 8 3	3 8 3
1939	2 19 9	2 19 9	2 19 9	2 19 9	2 19 9	2 19 9	2 19 9	2 19 9	2 19 9	3 1 0	3 1 0	3 1 0	3 0 0½
1940	3 1 0	3 1 0	3 11 0	3 11 0	3 11 0	3 11 9	3 11 9	3 11 9	3 11 9	3 11 9	—	—	—
South Wales—													
1933	2 0 0	2 1 6	2 4 0	2 3 6	2 3 6	2 3 0	2 5 0	2 5 0	2 8 0	2 10 0	2 10 0	2 10 0	2 5 3½
1934	2 10 0	2 16 3	2 15 9	2 13 9	2 14 3	2 15 0	2 14 3	2 14 3	2 15 0	2 15 6	2 15 6	2 15 6	2 14 7
1935	2 15 6	2 15 6	2 15 6	2 15 6	2 15 6	2 15 6	2 15 6	2 15 6	2 16 1½	2 17 9	2 19 8	3 1 1½	2 16 2½
1936	3 2 6	3 5 0	3 5 0	3 5 0	3 5 0	3 5 0	3 3 0	3 2 0	3 2 0	3 4 0	3 4 0	3 4 0	3 3 10½
1937	3 5 0	3 10 0	3 10 0	3 8 9	3 8 9	3 8 9	3 8 9	3 8 9	3 8 9	3 9 9	3 9 9	3 9 9	3 14 7½
1938	3 10 0	3 10 0	3 10 0	3 10 0	3 10 0	3 10 0	3 10 0	3 10 0	3 10 0	3 10 0	3 10 0	3 10 0	3 10 0
1939	3 1 6	3 1 6	3 1 6	3 1 6	3 1 6	3 1 6	3 1 6	3 1 6	3 1 6	3 1 6	3 1 6	3 1 6	3 1 6
1940	3 1 6	3 1 6	3 11 6	3 11 6	3 11 6	3 12 6	3 12 6	3 12 6	3 12 6	3 12 6	—	—	—

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All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

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Notice

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line Minimum charge for one insertion 3/-

(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED

FOREMAN PATTERNMAKER.—Position required by patternmaker, 20 years' experience all classes of light to medium general engineering, automobile, metal and repetition work. City and Guilds Finals. Excellent references.—Box 562, Offices of THE FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

WANTED.—Manager for commercial and sales side for small jobbing foundry. Iron and non-ferrous, dealing in general castings.—Box 566, Offices of THE FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

WANTED. — Working Foreman Iron Moulder for Jobbing Foundry, Humber district.—Apply, Box 564, Offices of THE FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe, Bucks.

EMPLOYMENT REGISTER.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

EXPERIENCED IRONMOULDER seeks position as Foreman or Assistant. Accustomed light engineering, jobbing and repetition castings. Good technical training; willing to travel. (397)

FURNACE ATTENDANT, accustomed to metal mixing, cast iron and high-duty cast iron, seeks similar position with engineering foundry West Riding of Yorkshire district preferred. (398)

PATENTS

THE Proprietors of the Patent No. 398976 for "Improvements in or relating to a method of and apparatus for abrasive cutting of work" are desirous of entering into arrangements by way of licence and otherwise on reasonable terms for the purpose of exploiting the same and ensuring its full development and practical working in this country.—All communications should be addressed in the first instance to HASELTINE LAKE & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

THE Proprietors of the Patent No. 463115 for "Improvements in or relating to a method of and machine for treating a steel rope" are desirous of entering into arrangements by way of licence and otherwise on reasonable terms for the purpose of exploiting the same and ensuring its full development and practical working in this country.—All communications should be addressed in the first instance to HASELTINE LAKE & Co., 28, Southampton Buildings, Chancery Lane, London, W.C.2.

THE Proprietors of Letters Patent No. 296746 relating to Castings and Rolling Copper, desire to grant licences under the Patent to interested parties on reasonable terms for the purpose of exploiting the same and ensuring its full commercial development and practical working in this country.—Enquiries to be addressed to CRUIKSHANK & FAIRWEATHER, 29, Southampton Buildings, London, W.C.2.

MACHINERY

WANTED. — One Secondhand Junior Cupola of 10 cwt. per hour capacity. Equipment to be complete with staging, fan, piping, stand and motor to suit 400 volts, 3 phase, 50 cycle supply if possible. Please give full particulars, price, and state condition.—RAWDON FOUNDRY & ENGINEERING CO., LTD., Moira, near Burton-on-Trent.

PNEUMATIC MOULDING MACHINES

Macdonald Jolter, table 72 in. by 54 in.

Tabor ditto, table 27 in. by 20 in.

Tabor 21 in. by 16 in. squeeze.

Zimmerman Type R.P.W.2 Jolt Squeeze turnover, table 36 in. by 20 in.

Mumford Type (Jackman) Swing Headpress, 13 in. by 15 in. and 14 in. by 16 in.

Mumford Pneumatic Core Jolters having 15-in. by 20-in. and 12-in. by 12-in. tables.

Britannia No. 1 "Coventry" Pneumatic Turnover Jarr Ram, table 30 in. by 28 in.

50 Air Compressors; 500 Electric Motors, Dynamos, etc.

S. C. BILSBY, A.M.I.C.E., A.M.I.E.E.
CROSSWELLS ROAD, LANGLEY,
Nr. Birmingham.
'Phone: Broadwell 1359.

SAND MIXERS AND AERATORS.—The "Breakir" Centrifugal Machine is *THE* machine. Outputs 10 cwts. to 8 tons per hr.—W. BREALEY & Co. LTD., Station Works, Ecclesfield, Sheffield.

FOR SALE.—One Junior Motive Type Sand-slinger, built by the Foundry Plant & Machinery, Ltd., and only recently put into work. Travelling type with 7-tons sand bin with 12-ft. radius arm. The machine is complete and in first-class condition. Can be seen by appointment.—SIR JAMES FARMER NORTON & Co., LTD., Adelphi Iron Works, Salford 3, Manchester.

FOR Immediate Disposal.—One Used Cupola, 3 to 4 tons per hour, with drop bottom; and one ditto, 4 to 5 tons per hour, with Receiver, Keith Blackman Motor Fan and Pipes, 400/3/50 A.C.—E. A. ROPER & Co., Keighley.

THOS. W. WARD, LTD.

14 BABCOCK & WILCOX WATER TUBE BOILERS, heating surfaces 4,410 to 5,540 sq. ft.; pressure 200 lbs. per sq. in., with ECONOMISERS MECHANICAL STOKERS.
CROSS TUBE BOILER, oil-fired, 8 ft. 2 in. by 3 ft. 9 in., w.p. 80 lbs.
COCHRAN BOILER, 7 ft. 6 in. by 3 ft. 3 in., gas-fired, w.p. 100 lbs.
COCHRAN BOILER, 8 ft. by 3 ft. 9 in. by 100-lbs. w.p.
2,064 ft. of 13-in. diameter cast-iron Spigot & Faucet Piping in 12-ft. lengths.
684 ft. of 13-in. diameter cast-iron flanged Piping in 12-ft. lengths.

Write for "Albion" Catalogue.
ALBION WORKS, SHEFFIELD
'Grams: "Forward." 'Phone: 26311 (15 lines).

FOR SALE.—1-ton Foundry Crane Ladle, 4-ton Foundry Crane Ladle, 30-cwt. Foundry Crane Ladle, with worm tilting gear.—Apply E. HIND, LTD., South Bank/Tees.

MISCELLANEOUS

WANTED.—Supplies of broken Plumbago Crucibles. State quantity and price.—Box 560, Offices of THE FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

BILSTON FOUNDRIES. LIMITED, Highfields, Bilston, 'phone Bilston 41406, have still available a limited capacity for light castings work of national importance; could undertake approx. 25 tons per week, castings up to 3 cwts., first-class finish, sand-blasted, delivery and quality guaranteed. Immediate enquiries invited.

MISCELLANEOUS—*Continued*

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BY USING OUR

Foundry Blackings, Facings, Parting Powder, Core Gum, Terra Flake, Talc Coal Dusts, Ganister, Ceylon Plumbago (Imports direct). We definitely help to produce perfect Castings. Only the best minerals used in the making. A trial order will convince users of their economic value.

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PATTERNS IN WOOD AND METAL for all branches of Engineering. Moulding methods carefully considered.—FURMSTON & LAWLOR, Letchworth.

PUBLICATION

RYLAND'S DIRECTORY of the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades. New edition. Price 42s. cloth bound. — INDUSTRIAL NEWSPAPERS, LIMITED, 3, Amersham Road, High Wycombe.

'Phone: 22877 SLOUGH

TWO NEW Core blowers for bombs.

36" Cupola by Geo. Green.

48" Cupola by Constructional.

54" Cupola by Thwaites.

JOLT SQUEEZE "JACKMAN" MOULDING MACHINES, 14" x 16", as new. £90 each.

Morgan 250 lb. Tilting Furnace (Two).

Morgan 600 lb. Oilfired Tilter.

Lip Axis 800 lb. Oilfired Tilter.

NEW PIT FURNACES 150 lbs. capacity, oil or coke fired. £35 each.

NEW SHOTBLAST CABINET PLANTS with motor driven Exhaust Fans, complete, all sizes. Prompt delivery.

ALEX. HAMMOND, *Foundry Machinery Merchants.*
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